

**Report
State Wildlife Grants
T-1-4**

Endangered, Threatened and Rare Wildlife Conservation Projects

**Report for Project Year
September 1, 2007 – August 31, 2008**

NJ Department of Environmental Protection

DIVISION OF FISH AND WILDLIFE

ENDANGERED AND NONGAME SPECIES PROGRAM

EXECUTIVE SUMMARY

Project:	Bird Conservation
Federal Aid Project:	T-1-4 (State Wildlife Grants)
Segment dates:	September 1, 2007 to August 31, 2008
Total Project Expenditures:	\$413,324 (\$309,993 Federal, \$103,331 State)

JOB 1: Federal and State Listed Bird Species

OBJECTIVE: To halt or reverse the decline of endangered and threatened species populations through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review.

JOB 1A: Bald Eagle Monitoring and Management Planning

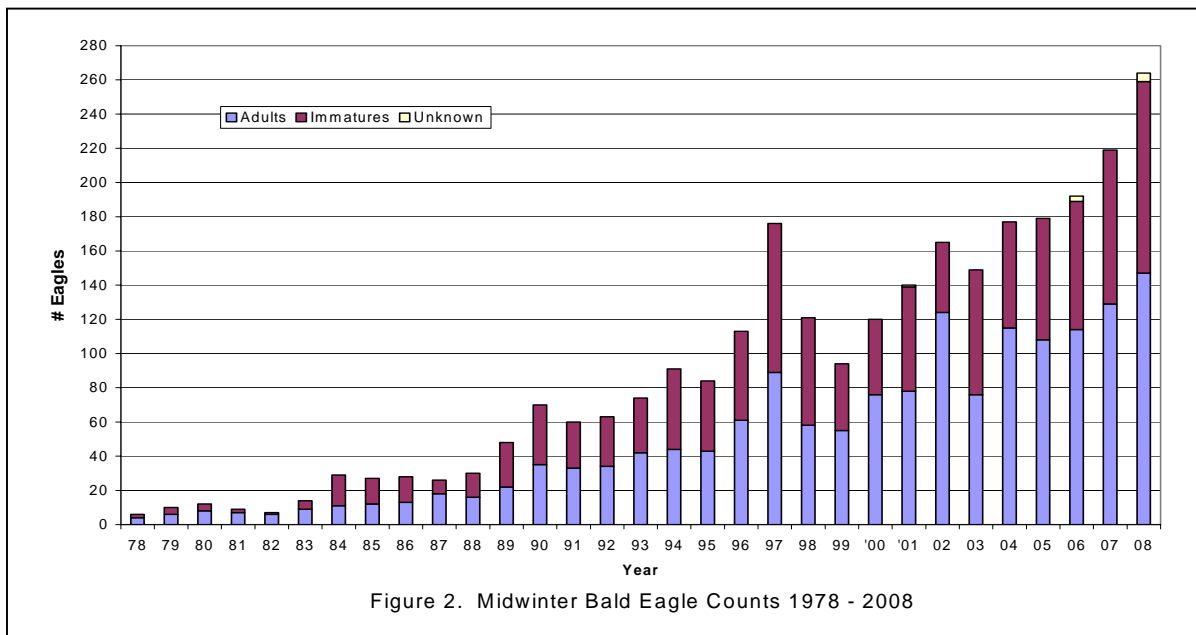
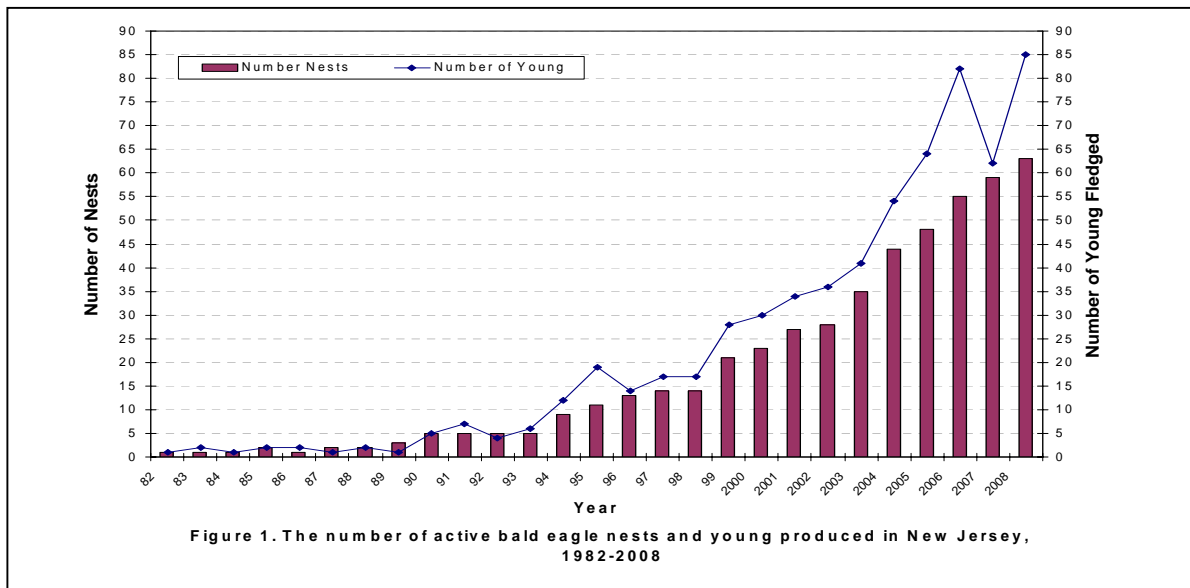
OBJECTIVE: To conserve and manage a self-sustaining bald eagle population in New Jersey; to determine the threat of environmental contaminants to survival of bald eagles along the lower Delaware River and upper Delaware Bay; and to monitor and conserve the wintering population of bald eagles in New Jersey.

Key Findings:

- ENSP biologists monitored all known nesting pairs, with the essential assistance of 55 eagle project volunteers. Nests were monitored approximately weekly from January through fledging in July.
- In 2008, 69 eagle pairs were monitored, 63 of those were active (with eggs), two were territorial (maintained a nest area), and four were not relocated when they moved (Figure 1).
- During the 2008 nesting season, 50 nests were successful in producing 85 young, for a productivity rate of 1.35 young per active nest. This productivity rate is more than the minimum necessary for a stable population, and represents a return to that level after the higher failure rate observed in 2007. This improvement is due in part to better weather conditions in the incubation period, and also to the addition of predator guards at trees that had problems last year. Nest success improved to 79% in 2008.
- Of 11 nest failures, two coincided with storms that damaged nests, three occurred when two to four-week old nestlings were predated, three occurred at first-year nests (which is not uncommon), and the remainder occurred during incubation for unknown reasons. Two pairs that failed during initial incubation re-nested and fledged one each.
- Six new eagle nests were discovered: one in north Jersey in Bergen County, two in central Jersey (Mercer and Burlington counties) and three in Cape May and Cumberland counties. Eagle nests have been documented from 19 of the state's 21 counties, although they are currently found in 17 counties.
- ENSP biologists visited a sample of nests to band young with federal and color leg bands and to take blood samples. In 2008 we banded 25 eaglets at 15 nests. We took blood from 23 eaglets and stored it for future analyses.
- Most nests (41, or 61%) were located on private land, with the balance on state, federal, county, and conservation lands.
- Relationships with landowners, whether private citizens, conservation organization, or public agencies, all required attention and directed management to ensure protection from disturbance or significant habitat alterations.
- ENSP biologists coordinated the Midwinter Eagle Survey that took place January 12-13, 2008. A total of 264 bald eagles was counted by volunteers and staff, 20% more than in 2007 and a new high count in New Jersey since the survey began in 1978 (Figure 2). Most eagles (221) were observed in southern New Jersey, primarily in the Delaware Bay region; northern New Jersey had 43 bald eagles on the Delaware River and on inland reservoirs. Surveyors recorded detailed data on eagle locations,

and those data were compiled to help document critical eagle wintering habitat. Total figures also were reported to the USDOJ Bureau of Land Management's Raptor Research and Technical Assistance Center, which compiles national winter eagle counts.

- Staff used Midwinter Survey point-location data to identify important wintering habitats. Data from past surveys (2002-2006) were digitized, and polygons were digitized from those points. Continued surveys of these sites during annual Midwinter Surveys will help track their use over time. The condition of wintering habitats can be tracked as land use/land cover mapping is updated.
- All new nests were GPS'd in the non-nesting season and were added to the database. Revised Landscape Project mapping that included new nests was provided to DEP offices for use in environmental review.
- Staff reviewed USFWS management guidelines and the post-delisting monitoring plan, and began planning New Jersey's role and response to the suggested actions and protection guidelines.
- No action was taken on comparing management practices for efficacy. Currently, management is designed for specific nest sites to address on-site issues in the context of site conditions (habitat and other).
- ENSP staff worked with Bureau of Law Enforcement to address specific problems at nest sites, and included Law Enforcement officers in the pre-season eagle project orientation meeting.



Conclusions:

- The New Jersey bald eagle population has increased each year and continues to maintain nest productivity above the minimum necessary to maintain a stable population. The state's eagle population has been increasing since the late 1980's, when one nesting pair existed in the state, but population growth has been most substantial only since 2002. Management by biologists that includes nest-site protection in cooperation with landowners has been key to success in NJ. In 2008, six new eagle nests were discovered, and expansion into unoccupied habitat is likely to continue in the next few years.
- While the strength of the current recovery is encouraging, most of the population growth is very recent and must be viewed with care. Regulatory protection levels, nest site protection, and efforts by nest observers and landowners have been essential ingredients in the current recovery, and will be necessary to sustain it. With federal delisting and strengthening of the federal Bald and Golden Eagle Act, we anticipate a substantial level of coordination with the USFWS will be necessary to minimize disturbance and habitat loss due to development and other activities.
- As evidenced by the 2007 drop in productivity, harsh weather conditions during sensitive incubation and early hatching periods can have a significant effect on nest success. It remains important to continue close monitoring for the foreseeable future to measure nest occupancy and success to assess eagle recovery in the state.
- Disturbance is a major management issue at many nests, and posting and regular surveillance by staff and nest observers are essential to protecting nests and ensuring the chance of success.
- Contaminants may be affecting nest success at several nests in the lower Delaware River region at a localized level. Regular nest failures often cause eagles to relocate to an alternate nest, making site management and habitat protection more complex, especially in the face of development pressure. Planning is necessary to manage for long term recovery as well as development needs.
- The majority of nests are located on privately owned land, making landowners central partners in the maintenance of the eagle population. While many landowners have become staunch advocates for the eagles and work closely with the ENSP biologists, others may have other goals for their land that may threaten long-term habitat viability.

Recommendations:

- Continue to monitor population size, activity and productivity through weekly or bi-weekly observations of nests. In addition, conduct surveys and report results to the U. S. Fish and Wildlife Service in accordance with the post-delisting monitoring recommendations. Coordinated monitoring calls for participation in the national survey in 2009, for which NJ will report using the list method.
- Continue to monitor the New Jersey wintering population through the annual Midwinter Eagle Survey in January, in coordination with regional and national efforts.
- Continue to monitor population health indicators by visiting a representative sample of nests to band nestlings with USFWS bands and state color bands, take measurements and blood samples.
- Monitor for environmental contaminants in the population by 1) annually taking blood samples from nestlings and 2) regularly testing eagle prey animals for contaminant exposure.
- Continue to work with Division of Law Enforcement, private landowners, nest observers, conservation organizations, and local governments to ensure protection of nesting and foraging sites.
- Work with the NJ Field Office of the USFWS to maintain essential nesting habitat free from disturbance, in accordance with state law and the federal Bald and Golden Eagle Act. Develop proactive planning to identify and conserve suitable bald eagle habitat in anticipation of a fully recovered eagle population.

JOB 1C: Beachnesting Birds (Black Skimmer and Least Tern) Population Monitoring, Threat Assessment Studies and Management Planning

OBJECTIVE: To protect and restore nesting black skimmers (*Rynchops niger*) through continued monitoring of nesting sites and by studying the effects of watercraft on their reproductive success. To protect and restore least terns (*Sterna albifrons*) and other beach nesting birds through development of targeted predator management strategy.

Key Findings:

- Black skimmer breeding surveys were conducted approximately every 2 weeks from the beginning of June until the end of August at back bay islands along the entire length of Barnegat Bay. Active nesting occurred on six islands within the bay (West Vol, Cedar Bonnet, North Egg, Mordecai, East Sedge, and Good Luck Sedge). A total of 558 adults were present at these sites (based on a cumulative total of peak counts). Just over three-quarters (77%) of the breeding adults were present at one site – Mordecai Island. A peak total of 282 nests were found during the surveys, with the majority of the nests (215) being at Mordecai Island. Productivity was very high at the Barnegat Bay island sites with a fledge rate of nearly two chicks per pair from all the colonies combined (551 chicks/282 pairs – peak count). All but one very small colony fledged young. Tidal flooding and heavy rain, which has resulted in nest and brood losses in other years, was only a minor factor this year.
- In addition to the surveys within Barnegat Bay, black skimmers were also monitored on Atlantic Coast barrier and inlet islands. A total of four active colonies were identified (Holgate, Seaview Harbor Marina, Champagne Island, and Cape May Meadows). The largest colony in the state, by far, was at Champagne Island, where 2,047 adults were counted, including a peak count of 844 on nests. This colony totally failed due to flooding over a several day period at the end of July/beginning of August. Many of those birds subsequently moved north to Seaview Harbor Marina where they joined a small existing colony (170 adults/72 nests, peak count). Although very late in the season, at least 250 of the Champagne Island pairs renested at this location. At the time of this report that colony was still active (i.e. unfledged young still present) so a final tally of fledges is not available although it appears that between 300-400 young will fledge from the site for the year. That was the only Atlantic Coast colony to fledge young.
- Significant movement between the colonies this year makes a statewide population and reproductive assessment difficult, but based on the highest count during an individual census period (which should minimize double-counting), preliminary results indicate 2,787 adults statewide, including 1220 on nests (apparent pair count). Between 850-950 young are expected to have fledged statewide (once figures from the Seaview Harbor Marina colony are final).
- A three-year study which investigated the impacts of watercraft on the reproductive success of black skimmers nesting on the back bay island colonies in Barnegat Bay was completed and reported in the segment ending August 31, 2007.

Conclusions:

- The number of black skimmers nesting on Barnegat Bay islands was nearly the same in 2008 as in 2007 (558 total adults versus 528, respectively). One large colony (Mordecai Island) accounted for 77% of the entire Barnegat Bay population. Productivity was robust in Barnegat Bay, but was still largely driven by the success at Mordecai Island (just over two chicks fledged per pair/215 pairs). The high fledge rate at Mordecai Island was encouraging as only a small number of young fledged last year (due to flooding), but that site had been highly productive in the previous four years.
- The failure of the Champagne Island colony was discouraging as it accounted for the majority of the state population this year, it received a particularly intense monitoring effort, and it produced nearly all of the young fledged in the state last year. Nonetheless, the failure was partially offset when some of the pairs renested and fledged young later in the year at Seaview Harbor Marina.
- The number of black skimmers nesting statewide showed a strong increase in 2008 as compared to 2007 (2,787 total adults versus 2,103, respectively, based on the highest individual census count).

Likewise, the number of adults on nests (apparent pair count) increased in 2008 (1,220 versus 930 in 2007). Even with the complete failure at Champagne Island, productivity in 2008 was comparable to 2007 – exact figures cannot be provided because final tallies are not available for the Seaview Harbor Marina colony, but preliminary estimates place statewide productivity in the moderate range at about .75 chicks fledged per pair. Although the vast majority of statewide population was still concentrated in just two colonies, the total number of colonies increased in 2008 (10 versus 6 in 2007). The increase in the number of colonies and the viability of the colony at Seaview Harbor Marina (a completely new breeding site for skimmers), somewhat lessens recent concerns about the vulnerability of the statewide population because of its concentration into just a few colonies.

Recommendations:

- Continue to annually monitor population and productivity at black skimmer nesting sites within Barnegat Bay and along the Atlantic Coast once every 2-3 weeks during the breeding season in order to make a statewide assessment of population trends.
- Although no significant nesting has recently occurred outside the Barnegat Bay and Atlantic Coast regions, periodically monitor other back bay island complexes within the coastal region of the state to insure that large numbers of skimmers are not nesting in these areas.
- Because of the small number of colonies statewide, management efforts and monitoring of human disturbance should be particularly rigorous for all active colonies. Large colonies, such as at Champagne Island, which have accounted for over three-quarters of the state's overall population in recent years, should receive the highest level of protection possible.
- Continue to incorporate breeding data into the Landscape Project and Biotics databases.

JOB 1D: Osprey Monitoring and Management Planning

OBJECTIVE: To conserve and manage the New Jersey osprey population at a self-sustaining level.

Key Findings:

- NJ Division of Fish & Wildlife biologists and volunteers conducted ground surveys in June and July 2008, resulting in a statewide nest-check of 286 pairs (Table 1). The outcome was known for 240 (86%) of those nests. Nests were grouped by watershed or water-body.
- Nest success averaged 1.87 young per active nest, roughly double the rate needed to sustain a population. Average nest success was somewhat higher in Delaware Bay compared to Atlantic coast (2.05 vs. 1.81), and varied from 1.55 in Sea Isle City to 2.25 in Barnegat Bay.
- During ground surveys 357 nestlings were banded with USGS aluminum bands, which will allow future tracking of migration pathways and returns to natal areas.
- Most nests (79% of those checked) were along the Atlantic coast where many new platforms have been erected over the past three years to increase productivity and maximize suitable habitat. In 2007 and 2008, over 40 nest platforms were installed with funds from private donations.
- All nest locations were maintained in Excel and GIS databases to track all occupied nests. Those databases were used to update the state's Biotics database, which is the basis for the Landscape Project critical habitat mapping. The osprey habitat model for use in Landscape was also updated with new information.
- Aerial and ground surveys to census the population are conducted every three years, the next to occur in 2009. This year approximately two-thirds of the population was surveyed, providing a good estimate for the rate of production for the state. Ground surveys during the banding period were conducted by staff and volunteers, and covered all major nesting areas including Delaware Bay and Raritan Bay south to Cape May. Two new volunteers were recruited and will be trained in spring 2009.
- Twenty addled, unhatched eggs were collected opportunistically (post-term) and stored for future use in contaminant studies.

- We provided advice on nest and nest-site management to the US Coast Guard (Aids To Navigation), cell phone and power companies to minimize disturbance at active nest sites. In most cases this meant directing structure maintenance issues to the non-nesting season.
- Research on fisheries trends was not conducted during this segment. That is an occasional task to be conducted when productivity and population trends suggest a negative linkage.

Conclusions:

- In 2008, 286 nests were surveyed, approximately 71% of the active nests recorded in the 2006 statewide census (the last census that was conducted).
- Nest success was well above average, suggesting that food resources were good near all the major nesting colonies. It also suggests that the nesting substrate, primarily custom-built platforms, serve ospreys well and may deter predators.
- ENSP coordinated and worked closely with volunteers to survey all major nesting colonies to estimate population parameters and to band young.
- The rate of population growth has slowed in recent years from 19.2 nests/year (90-99) to 9.2 nests/year (99-06), which would be expected if the population is reaching limits of suitable nest structures and, possibly, prey abundance.
- Ospreys' reliance on human-made structures for nesting emphasizes the importance of building and maintaining nests. This is a long-term job necessary to maintain the osprey population in the state. Use of donated funds and volunteer labor has made nest installation cost-effective, and instills stewardship of this species and its habitats.

Recommendations:

- Conduct a population census every three years (next survey due in 2009) to monitor population changes statewide and regionally. Maintain integrated databases on the population and nest locations on an annual basis.
- Continue to measure annual productivity of ospreys to monitor regional conditions and changes (e.g., Atlantic vs. Delaware Bay regions, and Atlantic subregional comparisons). Recruit and train more volunteers to assist with nest checks. Investigate a data-reporting system to ease data handling.
- Continue to collect addled and unhatched eggs to archive for monitoring contaminant levels regionally and statewide.
- Gather information on fisheries trends (particularly menhaden and flounder species) for potential correlation with osprey population parameters.

Table 1. Osprey nesting and productivity in 2008 in all NJ nesting areas. Productivity determined by ground surveys in June-July. Productivity rates in 2005-2007 provided for comparison.

Nesting Area	# Nests Surveyed	Known-Outcome Nests	# Young	# Banded	Production 2008	Previous Years		
						2007	2006	2005
Delaware River & North Jersey	n/a	n/a	n/a	n/a	n/a	n/a	1.00	n/a
Raritan Bay area (w/Cheesequake)	20	15	25	9	1.67	1.38	1.35	1.91
Barneget Bay	17	12	27	16	2.25	2.06	n/a	n/a
Sedge Islands WMA	24	20	35	22	1.75	1.15	1.57	1.33
Great Bay to Atlantic City	30	21	42	40	2.00	1.95	1.56	1.91
Great Egg Harbor/Ocean City	42	36	62	53	1.72	1.52	1.65	1.44
Sea Isle City	13	11	17	10	1.55	1.75	2.10	1.22
Avalon/Stone Harbor	47	38	67	56	1.76	1.93	1.64	1.28

Bays								
Wildwood Bays & Cape May	34	32	60	51	1.88	1.89	1.89	1.89
Maurice River & Estuary Marshes	48	45	95	93	2.11	2.07	1.84	1.37
Salem Co./ Artificial Island / Delaware	11	10	18	7	1.80	1.70	2.00	n/a
Other-Atlantic (no area designation)	n/a	n/a	n/a	n/a	n/a	n/a	1.29	n/a
TOTAL of Study Areas	286	240	448	357	1.87	1.78	1.66	1.54
Atlantic Coast only	227	185	335	257	1.81	1.72	1.74	1.53
Delaware Bay only	59	55	113	100	2.05	2.00	2.06	1.37
Total Statewide (census)							400	

JOB 1E: Colonial Waterbirds

OBJECTIVE 1: To study and analyze population distribution and trends for nesting populations of colonial waterbirds. Particular attention will be given to New Jersey’s state endangered and threatened species, species of species concern and regional priority species, such as yellow-crowned night-herons (*Nyctanassa violacea*), tri-colored herons (*Hydranassa tricolor*) and snowy egrets (*Egretta thula*).

Key Findings:

- A long-legged wading bird aerial survey was not originally part of this proposed segment, although it is a standard approach in this job. ENSP staff decided to shift the funding to conduct an aerial survey when it appeared the budget allotted for other SWG jobs was not going to be used in its entirety.
 - For the majority of the species, the downward decline that has been observed in recent surveys continued. Graph 1 and Chart 1 show the survey results for each species in 1985 and 2008 (one of the earliest and the most recent surveys, respectively). One obvious exception is the great egret, which has posted increased population numbers recently. Yellow-crowned night herons have also not declined but they have not increased in the way great egrets have. They appear to be stable over this time period. All other species have declined significantly.

Graph 1. Number of long-legged wader individuals: 1985 vs. 2008

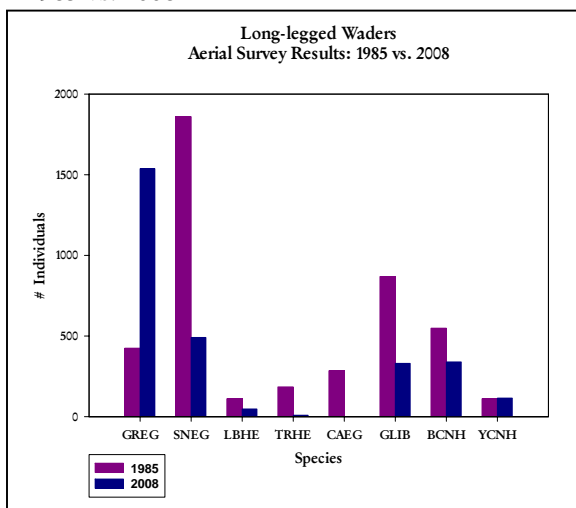


Chart 1. Number long-legged wader individuals: 1985 vs. 2008

Species	1985 Individuals	2008 Individuals
Great Egret	424	1538
Snowy Egret	1860	491
Little Blue Heron	111	47
Tricolored Heron	184	9
Cattle Egret	284	0
Glossy Ibis	869	330
Black-crowned Night Heron	548	339
Yellow-crowned Night	111	115

- The numbers of colonies for each species told a slightly different story (Chart 3). Some of the number of colonies each species were found in has been relatively stable since 1995 (the year in which colonies were standardized and can be compared), such as great egret, snowy egret, black-crowned night heron, and yellow-crowned night heron. Other species have seen declines, including little blue heron, tricolored heron, and cattle egret. Although snowy egret colony numbers are relatively stable, the number of individuals in those colonies has dropped. Great egret colony numbers are also relatively stable but they have increased their population quite drastically. All the species whose numbers are declining precipitously are also experiencing a drop in the number of colonies they are found in.

Chart 3. Number of colonies in long-legged waders: 1995 vs. 2008

Species	1995 Colonies	2008 Colonies
Great Egret	25	26
Snowy Egret	26	23
Little Blue Heron	19	12
Tricolored heron	18	5
Cattle Egret	4	0
Glossy Ibis	20	11
Black-crowned Night-heron	27	24
Yellow-crowned Night-heron	17	15

- Digital images were taken using a Nikon SLR camera of various colonies. This was to determine if counts could be conducted post survey by projecting the images taken on the flight and counting the birds in the colony. When images were projected, it was impossible to distinguish the light plumaged species from one another and the dark plumaged species were not visible enough to count, much less distinguish one species from another.

Conclusions:

- The majority of the populations of the species surveyed on the 2008 aerial survey (great egret, snowy egret, little blue heron, tricolored heron, cattle egret, glossy ibis, black-crowned night heron, and yellow-crowned night heron) are continuing to show a downward trend of their populations. This is a troublesome trend that is consistent with survey results elsewhere on the Atlantic coast. The reasons for the decline are not clear although it is not likely to be loss of habitat. The marsh islands that are surveyed in this effort have not been physically altered in any obvious way and are protected from development by state regulations. The other likely factors for low populations (which ultimately stem from low reproductive success) are predation pressures and lack of quality foraging habitat. It is not known at this time which of these factors (or others) is responsible for this downward trend.
- The significant increase in great egrets among the steep declines among other species remains perplexing, especially considering that the various species coexist in the same nesting colonies. This increase does lend some credibility to a theory that foraging is more of a problem than predation. Although great egrets are the largest of the species surveyed, their eggs and young are not significantly larger than the likely predators (mammals like fox and raccoon, birds like gulls) would avoid them. Their nests are found in the same vertical column as other species and great egrets are not any more aggressive than other species in defending their eggs or young. However, their larger size, and subsequently larger bill size, does mean that they are foraging on different prey items than the smaller herons and egrets. Perhaps this size difference in prey items plays a role in the decline most of them are facing that the great egret is escaping.

- The number of colonies that the species are found in is either stable or declining. There are no species in which the numbers of colonies have increased. This is not likely to be from lack of habitat, as many marsh islands appear suitable for nesting. The flat or declining colonies is probably solely a function of the decline of many of the species surveyed.
- The digital camera was useful in that it provided images of the colonies from an angle that would otherwise be impossible to view after the survey was over. However, it was not useful in providing an additional method to count colonies.

Recommendations:

- Continue the aerial survey effort as it represents one of the longest, most consistently completed surveys for nongame species in New Jersey. Discontinue ground surveys as alternative method.
- Restore or enhance marsh island habitat to attract additional marsh nesting birds to NJ. Although loss of habitat does not appear to be the primary factor in the decline, habitat improvements should always play an integral role in recovery efforts.
- Increase efforts to locate and map populations of species that nest in the interior sections of the state.
- Collaborate with other agencies along the eastern seaboard to coordinate survey and research efforts.
- Investigate the recovery efforts that other regions are undertaking for the declining species.
- Determine the limiting factor to population increase for the species that are experiencing declines. Possible channels to investigate include predation rates, contamination issues, quality of nesting habitat, and emigration to nesting sites in other states.

JOB 1F: Shorebirds - Conservation of Red Knot, Delaware Bay, New Jersey, USA

OBJECTIVE: Protect critical habitats and resources on the Delaware Bay stopover for migratory shorebirds through reduction/reversal of horseshoe crab population decline, reduction of anthropogenic disturbance to shorebirds, enhancement/creation of coastal habitat and impoundments, and monitoring abundance and condition of red knots and other shorebird species of regional priority.

Key Findings:

DELAWARE BAY STOPOVER

- Biologists from ENSP, USGS, British Trust for Ornithology, the Royal Ontario Museum and five other organizations developed and submitted a manuscript for publication that summarizes all data collected on the red knots on Delaware Bay, and creates recovery targets for population numbers, recruitment, survivorship, horseshoe crab egg density and weight gain. The manuscript was accepted and will be published in journal *Bioscience* in January 2009. The *Bioscience* manuscript was reviewed by a joint meeting of the Shorebird and Horseshoe Crab Technical Committees of the Atlantic States Marine Fisheries Commission (ASMFC) in October 2007.
- The metrics established in the *Bioscience* manuscript, will be used to develop a quantitative model to inform the ASMFC Horseshoe Crab Management Plan in setting harvest quotas of Delaware Bay horseshoe crabs. The conceptualization of shorebird and horseshoe crab models was developed at the above joint meeting in the form of a Structured Decision Making Workshop, sponsored by the USFWS and held at their training center in West Virginia. Work on models will continue into 2009.
- The immediate application of these recovery targets occurred in March 2008, when the New Jersey Legislature signed into law a moratorium on horseshoe crab harvest in the State. The reinstatement of New Jersey's crab harvest is now tied to the biological recovery of the red knot population and horseshoe crab egg densities on Delaware Bay in accord with numeric targets identified in the USFWS Red Knot Status Assessment published in 2007 (Niles et al 2007).
- Weekly surveys on Delaware Bay reflected a continued decline in the population of shorebirds, at a historic low over the 23 years of baywide aerial surveys. In 2008, the combined peak counts of red

knots, ruddy turnstones and sanderlings during the six-week aerial survey period was 50,110 individuals (Figure 1). This is a 72% decline from the 1986 total (177,490) for the three species.

- The 2008 red knot peak count was 15,395, 3,020 birds higher than 2007 and 1,420 birds higher than the average peak count of the last five years. Numbers were higher than normal in early June, which may represent longer stopover duration due to inadequate food resources. The slightly higher peak count of knots contradicts winter area counts (Florida, northern Brazil, Tierra del Fuego), which declined significantly in the past two years (Niles et al. 2008).
- The 2008 ruddy turnstone peak count was 21,300, a decline of >16,000 birds from 2007 (37,430). This was the second lowest peak count of ruddy turnstones recorded in the 21-year history of the survey. The decline in turnstone peak counts parallels the steep decline in red knot peak counts, falling from a high of 105,160 individuals in 1989.
- Sanderling peak counts increased by just over 4,500 birds to 13,415 (Figure 1).

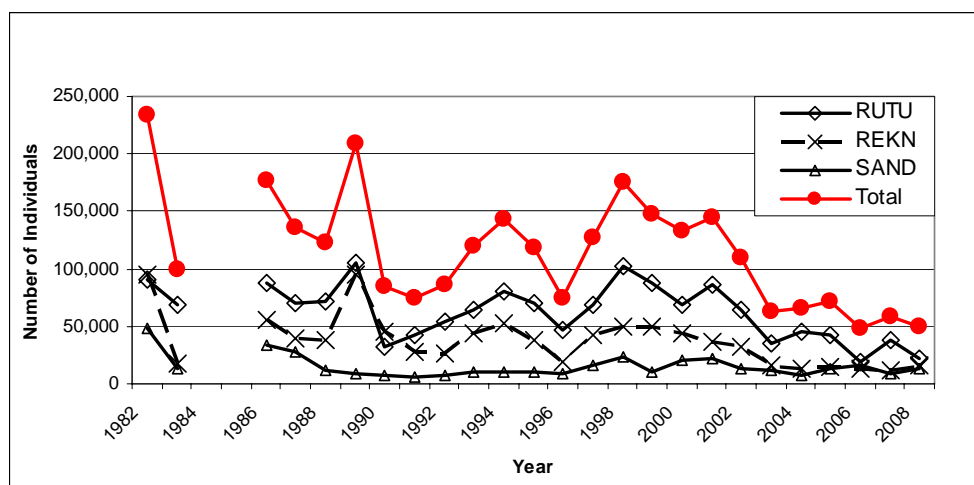


Figure 1. The peak counts of red knots, ruddy turnstones, sanderlings and the combined total of the three species in weekly aerial surveys of the Delaware Bay 1982-2008* (data from K. Clark, NJ DEP, and R. Porter). *May 21, 2008, count did not include ~11 miles of Delaware coast surrounding Dover Air Force Base.

- Over the period of intensive monitoring on Delaware Bay (1997–2008) mean catch weights of red knots 1997-2002 were generally at or above the mean for the period while mean catch weights for 2003-2007 were generally below the mean for the period (Figure 2).

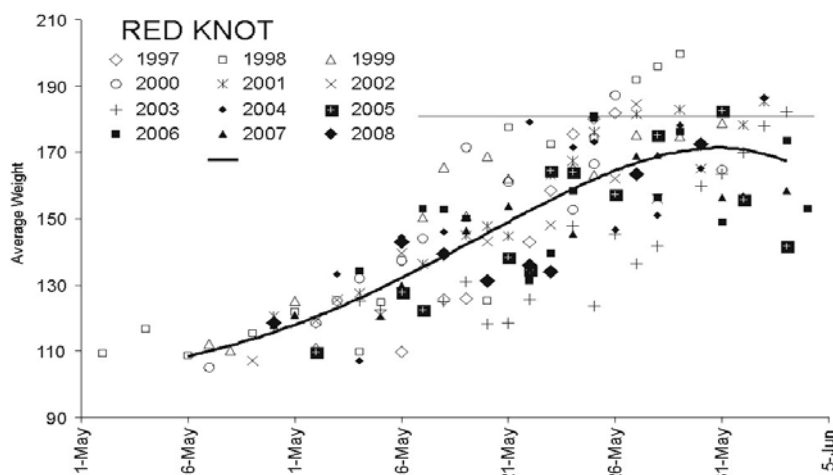


Figure 2. Weight gain curves for red knots from average weights of catches made in Delaware Bay 1997-2008*. Diamonds mark average weights/catch in 2008. Threshold weights necessary to reach the Arctic are shown as the horizontal gray line on each graph.
 *2008 represents NJ catches only as Delaware banding data were unavailable at the time of analysis.

- The most important measure of the success of the stopover on Delaware Bay is the proportion of red knots that reach threshold departure mass of 180 grams. Knots leaving the bay at ≥ 180 g have higher annual adult survival than birds departing at lower weight (Baker et al. 2004). This year only ~15% of the red knots that came to Delaware Bay reached the 180-g threshold weight, continuing a decline that is highly significant ($P < 0.001$) (Figure 3).

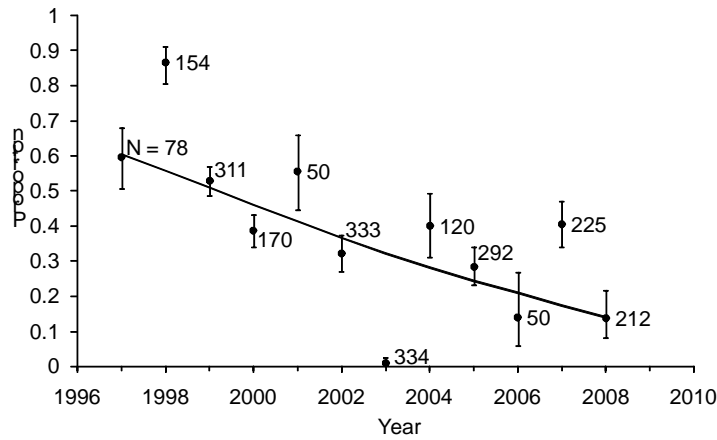


Figure 3. Proportion of knots with 95% C.I. in the >180 g body-mass category in Delaware Bay near the usual departure time each year (26-28 May) over the period 1997-2008. Numbers are total birds sampled.

- The viability of Delaware Bay remained impaired because of the continued low density of horseshoe crab eggs. The result is inadequate availability of eggs necessary to allow birds to refuel and go on to breed in the Arctic. Surveys of horseshoe crab eggs conducted over the last nine years showed no signs of improvement; 2008 densities were the lowest recorded (Figure 4).

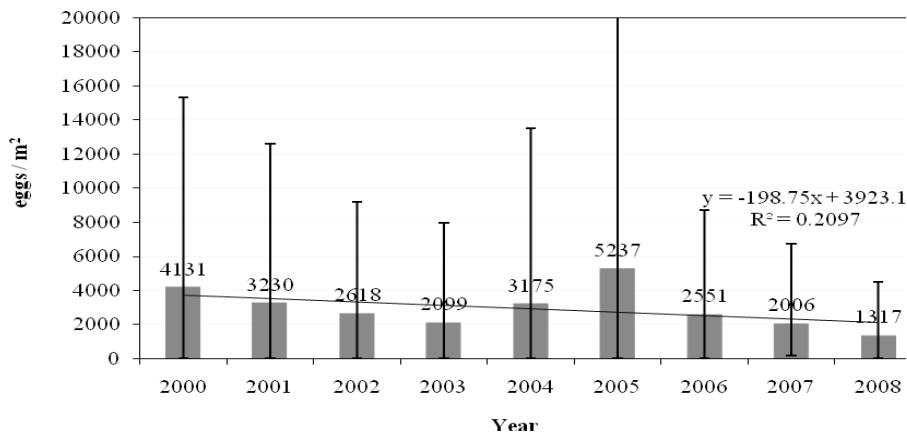


Figure 4. Horseshoe crab egg densities on the NJ shore of Delaware Bay 2000-2008. (data from D. Hernandez, Richard Stockton College)

- New Jersey and Delaware Divisions of Fish and Wildlife continued to collect feather samples (small portion of 6th primary covert) for isotope analysis from all red knots captured. As primary coverts are replaced on wintering grounds, this analysis provides a means of identifying where individuals are wintering and the proportion of birds from those wintering populations passing through Delaware Bay.
- Intensive resightings efforts for red knot, ruddy turnstone, and sanderling continued on both sides of Delaware Bay. Although 2008 marks the fourth full year of data collection for individually-marked birds (versus cohort markings), a re-analysis of adult survival has not yet been undertaken.
- As in 2007, gull exclosures were not erected in 2008.
- The NJ Division of Fish and Wildlife (DFW) and the Conserve Wildlife Foundation (CWF) biologists continued innovative management programs to improve conditions for knots and crabs.
 - Continuing since 2003, all important beaches on Delaware Bay were temporarily closed to human use to prevent the disturbance of feeding shorebirds.
 - Beach protection was expanded to include three Atlantic coast areas: Stone Harbor Point, Champagne Island (Hereford Inlet) and Malibu Beach Wildlife Management Area.
 - ENSP did not carry out telemetry work on red knot movements in Delaware Bay. In 2008, we continued collaboration with the Southeastern Cooperative Wildlife Disease Study (SCWDS), University of Georgia, in a telemetry project on ruddy turnstone to assess habitat use and daily movements relative to Avian Influenza risk factors. This project was funded by SCWDS with some logistical support from ENSP staff.
- Recommendations cited in the NJ State Wildlife Grants Report (NJ T-1-4) have been integrated into the Western Hemisphere Shorebird Reserve Network (WHSRN) Red Knot Conservation Plan and the USFWS Red Knot Status Assessment. NJ ENSP has taken on portions of these tasks and continued to work with WHSRN and other state and federal partners to encourage participation in necessary monitoring and protection.

SOUTH AMERICAN AND US WINTERING/STOPOVER AREAS

- The number of red knots in Tierra del Fuego declined from 17,211 in 2007 to 14,800 (Figure 5). That number is consistent with the model predicting extinction by 2010 (Baker et al. 2004).
- The most recent assessment of population counts (Niles et al. 2007) on the three main wintering sites, including Tierra del Fuego (14,800), Brazil (est. 3,000) and Florida (est. 3,550), suggests a total estimated red knot population of approximately 21,350 birds, much lower than an original estimate of over 150,000 birds.
- Stable isotope analyses of feathers from knots captured on Delaware Bay and resighting of birds banded on various wintering and stopover locations indicate the impact of diminished horseshoe crab resources falls primarily on knots wintering in Tierra del Fuego. However, the red knot population wintering in Florida and the southeastern US may be suffering mainly from reduced overwinter survival caused by a combination of factors including habitat loss, human disturbance, and beach replenishment activities that eliminate invertebrate prey populations reducing food availability.
- NJ ENSP continued monitoring of the main red knot wintering population on Bahia Lomas, Tierra del Fuego, Chile, under separate funding. Annual monitoring includes ground counts to validate aerial survey (conducted by Canadian Wildlife Service), capture and individually marking red knots to monitor body condition, and estimated recruitment and adult survival.

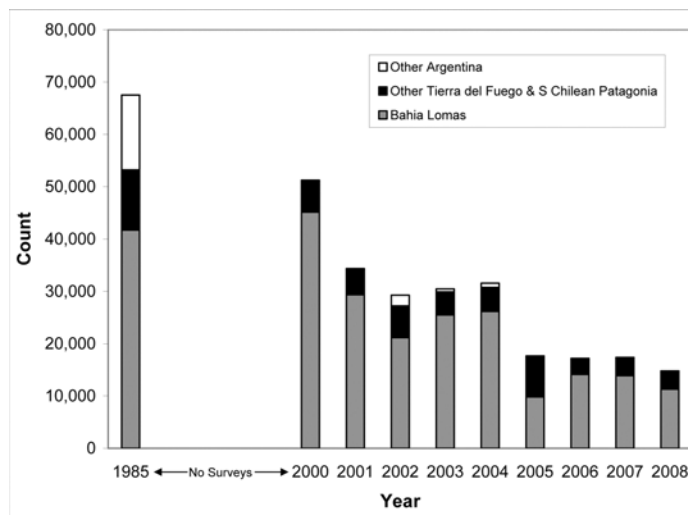


Figure 5. Red knot wintering population size in Tierra del Fuego was similar in 1985 and 2000 but dropped rapidly. Baker et al. (2004) concluded this large decline between 2000 and 2002 was attributed to adult survival which declined from a mean of 85% in the period 1994/95--1997/98 to 56% during 1998/99–2000/01 and recruitment into the second year cohort fell by 47%.

- NJ ENSP and the Conserve Wildlife Foundation of NJ continued to work with Florida Fish and Wildlife Conservation Commission to establish a monitoring program for the red knot wintering population in Florida including aerial and ground surveys to estimate winter population size, capture and individually mark red knots to monitor condition, estimate recruitment and develop adult survival estimates through rigorous resightings efforts.

ARCTIC BREEDING AREAS

Key Findings:

- In 2008, Arctic studies were not undertaken.

CONCLUSIONS:

DELAWARE BAY STOPOVER

- The red knot population on Delaware Bay increased slightly in 2008. This counters declines seen in wintering areas and may represent a longer stopover duration on Delaware Bay because of inadequate food resources. Low egg densities related to low water temperature from the May 11th storm did not recover even after conditions improved, suggesting continued low spawning densities in NJ.
- Current egg densities (1,317 eggs/m²) are insufficient to support even a greatly-reduced migrant shorebird population and must be increased to a minimum of 50,000 eggs/m² to begin recovery of the stopover. Therefore, closure of crab harvest and/or significant coast-wide harvest reductions, particularly for crabs belonging to the Delaware Bay breeding population, may be necessary to preserve breeding crabs and increase eggs on the beach.
- The State of New Jersey legislated a moratorium on horseshoe crab harvest in NJ until red knots and horseshoe crab eggs recover to target levels specified in the USFWS red knot status assessment (Niles et al. 2007).
- Other shorebirds, including the ruddy turnstone and semipalmated sandpiper, appear to be following declining trends similar to red knot.
- Analogous to red knot, semipalmated sandpipers have declined in the rate of mass gain while on Delaware Bay (Peters et al. 2007).

SOUTH AMERICAN AND US WINTERING/STOPOVER AREAS

- Bahia Lomas remains the most important wintering site for red knots in the Western Hemisphere.
- The greatest threat to the Tierra del Fuego population is declining horseshoe crab egg resources on Delaware Bay. The Chilean government is willing to increase protection on Bahia Lomas with the professional and monetary assistance from groups in the US.
- The west coast of Florida is the most important wintering area for the *rufa* red knot in the US but the least well-studied of the three wintering populations. The Florida wintering population has likely suffered declines because of habitat loss, disturbance and reduced food resources.
- The status of the northern Brazil wintering population is believed to be stable; however, systematic surveys are required.
- Application of the WHSRN Site Assessment Tool and development of management plans for important sites will require funding and survey effort by government agencies and non-government organizations. Moreover, greater federal agency participation and support would help states develop better regional monitoring and protection systems for shorebirds.

Recommendations:

DELAWARE BAY STOPOVER

- Recover and maintain Delaware Bay horseshoe crab egg densities at levels sufficient to sustain stopover populations of all shorebirds including 100,000 red knots. In part this will be supported by:
 - Continuation of all current yearly studies on Delaware Bay of shorebird numbers, rate of mass gain, and horseshoe crab egg densities, as continuing inputs for models.
- Continue efforts to develop a system for annual determination of population status based on survey results, capture data and resightings of banded individuals in Delaware Bay and throughout the Atlantic Flyway.
- Develop annual estimates of productivity and juvenile survival as inputs for population models. Determine key southbound and northbound stopovers that account for at least 80% of stopover areas supporting at least 100 red knots, and develop coast wide surveillance of birds as they migrate.
- Control disturbance at all stopovers and wintering areas.

SOUTH AMERICAN AND US WINTERING/STOPOVER AREAS

- By 2009, determine the genetic and breeding status of the three main wintering populations (Tierra del Fuego, Maranhao and Florida).
- By 2011, create a hemisphere-wide system of protected areas for each significant wintering, stopover and breeding area.
- By 2009, complete site assessment, using Western Hemisphere Shorebird Reserve Network (WHSRN) site assessment tools, for Bahia Lomas, Rio Grande, San Antonio Oeste, Lagoa do Piexe, Maranhao, the west coast of Florida, the Altamaha Region of Georgia, the Virginia Barrier Islands, Delaware Bay, Stone Harbor Point, James Bay, Southampton Island and King William Island.
- By 2009, delineate and propose protection measures for key habitats within the main wintering areas of Maranhao, Tierra del Fuego and Florida, and develop management plans to guide protection.

ARCTIC BREEDING AREAS

- Repeat surveys of nest density surveys on Southampton Island, Nunavut, to continue long-term monitoring of trend in red knot and American golden plover breeding densities relative to food resources on Delaware Bay.
- Collaborate with US and Canadian researchers to develop an estimate of red knot juvenile survival (hatching to fledging).
- Identify all important breeding locations in Canada, and recommend protection needs for the top ten sites.

JOB 1I: Piping Plover

This job is jointly supported by State Wildlife Grants and Section Six funding.

OBJECTIVE: To improve piping plover (*Charadrius melodus*) reproductive success by creating and maintaining additional foraging opportunities (artificial ponds) for chicks in areas sheltered from human disturbance. This project meets recommendations of the USFWS Piping Plover Recovery Plan, where one goal is to “draw down or create coastal ponds to make more feeding habitat available”.

Key Findings:

OBJECTIVE 1

- Experimental foraging plots (10' x 25') were lined with a thick plastic liner and then covered with approximately 6" of sand which proved effective for:
 - Preventing water from percolating through the sand and instead allowing it to pool.
 - Allowing a wet microhabitat to flourish and wetland consistent plants to grow at perimeter.
 - Easy installation and removal.
- “Jetting” continued to be the best option for installing the wells, although there were some problems this year. The wellpoints were made of PVC pipe and had a 4” diameter. This large size sometimes made it difficult to jet the wells in. The well in Ocean City took two days to install and the well at the Coast Guard Training Center (TRACEN) was aborted after two unsuccessful attempts where the hard substrate made it impossible to puncture with a blunt-end wellpoint. Due to the increased amount of time (and additional equipment) needed for the Ocean City and TRACEN installations, another site was not added to the roster this year.
- After experimenting with other types of pumps in past years, the Lorentz submersible was the sole type of pump used this year.
- 2-Mile Beach
 - This is a site that is closed to the public during the breeding season. The well installed at this site (in fall 2007) was located about 40' from the original location of the well that was used in 2006, which was designed for a surface pump. After the submersible well was installed and the pump set up, a pungent smell associated with the water was detected. The smell seemed to have some sort of petroleum base to it and it was deemed unsuitable for the foraging experiment in the event the smell was associated with toxic components. In 2008, we worked with Stockton College chemistry professors to test the water to determine if the source of the smell can be determined.
- TRACEN
 - Installing the 4” diameter well point proved more difficult than in the past. Installation was attempted in two separate locations and in each case the wellpoint sank to a shallow depth that was not suitable for this application. In both instances, the wellpoint appeared to hit an impenetrable (at least by a 4” blunt end object) portion of the substrate that caused the wellpoint to crack (discovered upon inspection after removing). At this point, it was decided to not continue as in addition to this problem, there was no additional specially ordered perforated wellpoint. There was not enough time to order new parts before the arrival of the piping plovers, which would be disturbed by the installation.
- Ocean City
 - Ocean City is a municipal beach whose summer population swells with tourists enjoying the coastal environment. Over the course of the 5 months that the equipment was visible (although inside the same light fencing that protects the plover nests and nesting areas) there were never any incidents.
 - The 4” diameter pipe was jet in using high pressure water. Installation was difficult but accomplished after two attempts. Although the 1.5” diameter pipe worked at this site last year, the 4” diameter pipe provided a much higher water flow rate, which was desirable. The 10'x25' plot was then lined with plastic and filled with wrack (to help retain moisture) and layered with fish fertilizer (to help attract invertebrates).

- In 2007, ENSP determined that the Conergy surface pump was too sensitive to the coastal environment and did not pump a sufficient amount of water for this application. Therefore, the Lorentz submersible pump was chosen for the project this year. Although it is the least powerful in its series, it out-pumped the recharge capacity of the well when running at full tilt. To prevent this problem, the RPM of the pump was set to its lowest setting and the system was regulated by a timer so it would run for 0.5 hours on, 2.5 hours off.
- A battery was added to the system this year, which allowed the pump to run continuously 24 hours a day. The resulting consistent flow, coupled with a plot being lined, allowed water to puddle, creating the desired effect of an artificial foraging area mimicking an ephemeral pool. The addition of wrack and fish fertilizer allowed the plot to flourish and by the end of the season the desired wet, productive microhabitat had emerged in the dry dune environment.
- No birds were observed utilizing the plot, although that may have been mostly a function of the lack of adults and chicks in the area since the nearest nest failed shortly after the start of the breeding season and the pair left the area.
- Invertebrate samples showed that the plot was producing food items consistent with a piping plover diet. This included members of the Diptera and beetle taxonomic groups. Samples were taken throughout the season by placing paint sticks covered in Tanglefoot®, a sticky substance intended for pest control. Two sticks (one vertical and one horizontal) were placed in two separate locations within each treatment (plot and control). See Chart 1 for results:

Chart 1. Results of Invertebrate Prey Sampling

		Foraging Plot		Control	
		Vertical	Horizontal	Vertical	Horizontal
Test 1 12-Jun	Location 1	1	1	0	3
	Location 2	1	1	0	2
Test 2 16-Jun	Location 1	1	4	0	2
	Location 2	0	7	1	4
Test 3 27-Jun	Location 1	1	5	1	0
	Location 2	0	2	1	1
Test 4 3-Jul	Location 1	0	1	0	0
	Location 2	0	7	0	0
Test 5 8-Aug	Location 1	1	7	0	0
	Location 2	4	33	0	2

- The municipality and school system of Ocean City were supportive and helpful with this project.
- Since the installation of the wells at the sites listed above were more difficult (and used more equipment than planned for) than expected, no additional sites were selected for foraging areas. However, the success of the project this year (as well as in 2007) suggests that it would work at other sites. Potential areas could include Monmouth Beach, Sea Bright, Barnegat Light or Avalon. It was determined that no state permits are needed for this project.

OBJECTIVE 2

- A contract with The Richard Stockton College of NJ – Coastal Research Center (CRC) did not transpire because a key staff member left his position to work with another agency out of state. His position was not filled at CRC and since the Weights of Evidence model was his specialty, the project parameters were readjusted to eliminate this type of analysis. Remaining staff at the CRC have been helpful, however, in providing information on a voluntary, as-needed basis.
- A digitized layer documenting all the piping plover nesting areas from 1987-2008 (previously only available from 2003) was created and overlaid with aerial images of the coastal region of the state.

- Distance to inlet appears to be a key factor in determining site selection among piping plovers. The majority of the nesting sites over the last 20 years have been located within one mile of inlets (Chart 1). This trend is even more apparent when looking at individual nests (these measurements took place from the exact location of individual nests versus the center of a nesting site which represents many pairs but is not as accurate a measurement.) The preference is obviously to use the measurements with a finer degree of accuracy, but nest point data is only available statewide for 2003 to the present. Those five years of nesting data are summarized in Chart 2.

Chart 1. Distance of nesting areas to nearest inlet

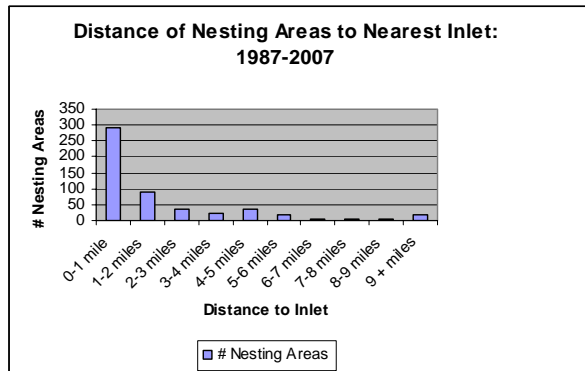
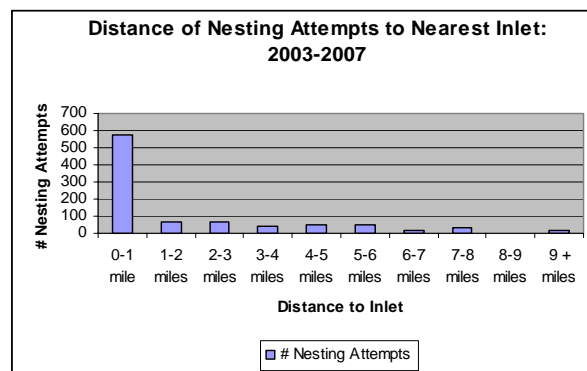


Chart 2. Distance of nesting attempts to nearest inlet.



- Nesting in the state not only related to the location of inlets but also seems to be focused around the inlets that have not been stabilized by jetties. There are 13 inlets in the state (including Sandy Hook Bay and Delaware Bay). Of these, 6 are natural and 7 are stabilized on one or both sides. Of the 2,192 nesting attempts that took place from 1995-2007, 1,674 were closest to a natural inlet (76%) and 518 (24%) were closest to a stabilized inlet (note: 1995 is when state records began to reflect all nest fate outcomes statewide; previously, the data are incomplete). Interestingly, nest fate (hatch, fail or unknown) was not linked to type of inlet and was identical no matter where the nest was located. At either type of inlet, 47% of nests hatched, 50% failed and 3% had an unknown outcome.
- Another predictor of nest locations was whether the site was on a barrier island or part of the mainland. New Jersey has about 132 miles of suitable habitat for piping plovers along its coastline. The majority of this habitat is on barrier islands (101 miles) with the rest on mainland beaches (31 miles). It is not surprising that the majority of the nesting pairs since 1987 have utilized barrier islands (2,268 versus 280 when summing pairs over all years). However, if a metric of pairs per habitat type is calculated, barrier islands not only attract more pairs, but produce more young per mile. Barrier islands averaged 22.4 pairs/mile and 22.8 fledges/mile while mainland habitats averaged 9.1 pairs/mile and 10.0 fledges/mile.
- Beach replenishments can have a positive impact on piping plovers' nesting areas. They can create nesting areas where none previously existed and sometimes plovers will exploit this additional habitat. However, this generally only occurs if there is a nearby source population to draw from. At sites where there is no source population or history of nesting at the site, piping plovers were not attracted to the new habitat. Piping plover nesting sites are sometimes also the indirect beneficiary of beach replenishments. As sand shifts and erodes from its intended location, it can be deposited at a site that is already an active plover site. This sand can create additional habitat at the active site and allow additional pairs to utilize the site.
- Reproductive success in the form of nest fate has remained fairly stable over the past 20 years, with roughly half the nests hatching and half failing (predated, flooded or abandoned). The cause of nest loss is variable and it is clear that some years flooding is the major factor while others it is predation. Exclosures do improve nest success on the whole, but their effectiveness has lessened over time, resulting in increased rates of abandonment. Chick loss is difficult to categorize (since there is often little to no evidence of why it occurred) but predation is believed to be a major threat. Nest initiation had no effect on reproductive success, nor did the landowner of the site (whether the nest was on

federal, state, or municipal land). The “first 72 hours” as the most critical period proved to be true at some sites, but chick loss was more uniform over time at other sites.

Conclusions:

OBJECTIVE 1

- Lining the plots with plastic continued to play an integral role in water retention. Used in combination with the timer assured that plot stayed wet virtually all the time, even in the hottest weather.
- The submersible Lorentz pump was finally able to be tested for an entire season without technical problems, and proved it was able to withstand the beach environment and salty water for the duration of a field season.
- A 4” diameter wellpoint (with gauge size 6 or smaller) is necessary to use the Lorentz pump, but there was difficulty in jetting them in this year at some of the sites.
- The solar power configuration continued to be a great success. The straightforward operation and the continued success of the panel throughout the season validated their continued use. They sustained no damage or obvious wear. Adding a battery to the system worked well, and it appeared from voltmeter readings that the battery was not discharging over the course of the season.
- Piping plover prey items were attracted to the site. As the field season progressed, the plot transitioned from a wet sandy area to a true microhabitat for foraging plovers. Wetland associated plants grew and the invertebrate population abundance increased over time.
- This was the second year utilizing a municipal site where the public had relatively easy access to the equipment but no interference was detected. In addition, this is the second year with no incidents, which is especially promising because municipal sites are located where artificial foraging areas are likely to be most effective.
- A strong working relationship with the municipality where the artificial foraging area is located is paramount to the success of the project.

OBJECTIVE 2

- The newly created digital layers of all known nesting areas from 1987-present will be a valuable new tool for species managers to utilize when making landscape level decisions.
- The importance of inlets to nest site selection cannot be understated. It is clear that the dynamic environment provided by inlets makes the surrounding area very attractive as a nesting area. Furthermore, inlets that are not stabilized are the preferred option. Given the lack of this type of habitat in the state, and the unlikely event that more will be created, there may not be enough suitable habitat available in NJ to recover this species.
- The preference of piping plovers for barrier islands versus the mainland may be a result of substandard habitat on mainland beaches versus barrier island habitats, as mainland beaches are more prone to be dynamic and likely to change. Piping plovers have shown a predilection for the type of habitat that dynamic coastal environments provide, such as overwashes and mud flats.
- Beach replenishments can be a source of additional habitat for piping plovers, provided there is a source population or history of nesting as the site. Unfortunately, these areas may be in locations where there is a conflict with human recreation activities and may lead to poor reproductive success among the pairs.
- The loss of nests by strong storm events in some years are unavoidable consequences of the habitat the plovers nest in. Predation, on the other hand, is a variable that is more easily controlled. The decrease of nest and chick loss to predation would greatly enhance the reproductive rate among nesting plovers and improve their chances of recovery.

Recommendations:

OBJECTIVE 1

- Continue to line foraging plots with plastic, add wrack and fish fertilizer, and use the battery/timer to ensure continued success of the system.

- Continue to use the Lorentz pump and the size 6 gauge wellpoint. Determine if there is a better method for jetting in the large 4” diameter well, perhaps adding a sharp tip to the presently blunt end to make it more able to pierce stubborn substrate.
- Continue and increase the use of municipal sites, concentrating on those where plovers are present and municipal support exists

OBJECTIVE 2

- Disseminate the piping plover digital layer (depicting nesting areas from 1987 – present) to state cooperating agencies, municipal staff, and anyone else who is involved with writing management plans or the management of this species.
- Work against any future plans to shore up the currently unstabilized inlets in the state. Roughly half already have one or two jetties, thus eliminating the natural movements and reshaping that usually is associated with inlets. If inlets are created as the result of strong storm events in areas that are not highly developed (where pressure would exist to close the inlet to protect property), work towards keeping the inlet open, which will create superb habitat for nesting plovers.
- Increase the restoration/enhancement efforts geared towards the improvement of habitat in nesting areas, including those on mainland beaches (such as the restoration project at Cape May Meadows).
- Work closely with the Army Corps to design beach replenishment projects to minimize impact to nesting birds, or to include features that will help facilitate successful interactions between people and birds if the plovers begin nesting there. This can be accomplished by the creation of detailed management plans with each municipality that is expecting to be in receipt of a beach fill.
- Increase predator control efforts at all sites where predation remains a barrier to strong reproductive success. Other states in the region have had great success with predator control efforts and New Jersey should follow their example on this issue.

JOB 1J: Raptors

OBJECTIVE 1: To inventory and monitor state-listed woodland raptor populations and their habitat, and determine population trends in relation to available habitat. To develop forest management practice guidelines and informational vehicles that help reverse the declines of the state-endangered northern goshawk (*Accipiter gentiles*) and red-shouldered hawk (*Buteo lineatus*), and the state-threatened Cooper's hawk (*Accipiter cooperii*) and barred owl (*Strix varia*). To determine the distribution of owls throughout NJ including the listed short-eared owl (*Asio flammeus*), long-eared owl (*Asio otus*), and barred owl (*Strix varia*), special concern species the common barn owl (*Tyto alba*), and other inhabitants including the great horned owl (*Bubo virginianus*), e. screech owl (*Megascops asio*), and the n. saw-whet owl (*Aegolius acadicus*); and develop baseline data for long-term monitoring of owl populations, distribution, and habitat selection.

Owl Distribution

Key Findings:

- Efforts were made to identify potential data sources (e.g., contacting local universities/colleges, local non-government organizations, and experienced volunteers and consultants).
- The on-line reporting system was not attempted this year. As last year, concerns remained for validating observations and/or accurately evaluating the observers' identification skills.
- Five experienced volunteers and consultants were contacted for owl observation data.
 - Two volunteers/consultants acknowledged they have additional owl observation data and agreed they should meet with staff to review the locations and information. Staff and volunteers/consultants were unable to coordinate their schedules to meet prior to the August 31 deadline.
- ENSP compiled identified owl locations from ENSP's Biotics database (including data through December 27, 2007).
 - ENSP's Biotics database provided fifty-five point locations of owl observations.
 - 55 point locations included 53 barred owls, 1 long-eared owl, 1 short-eared owl.

- Of the 53 reported barred owl observations, 50 barred owl observations fell within the home range (1000 meter radius) of a previous year's barred owl observation; 22 within 500 meters.

Conclusions:

- The effort to simplify the reporting process by holding one-on-one meetings with owl observers to provide a single map and list of locations, rather than multiple *Sighting Report Forms* (ENSP standardized reporting system), proved unsuccessful, as observers and staff were unable to coordinate schedules.
- Review of the distribution map (Figure 1) showed continued data gaps through the Piedmont Plains Region Landscape.
- Over 90% of the owl observations (94% of barred owl observations) were most likely observations of previously known occupied territories.

Recommendations:

- ENSP should review data compilation and evaluate the necessity of developing surveys to fill data gaps. If considered high priority, staff will use standardized survey protocol (i.e., incorporate accepted regional and national survey methods) and pursue funding to implement the project.

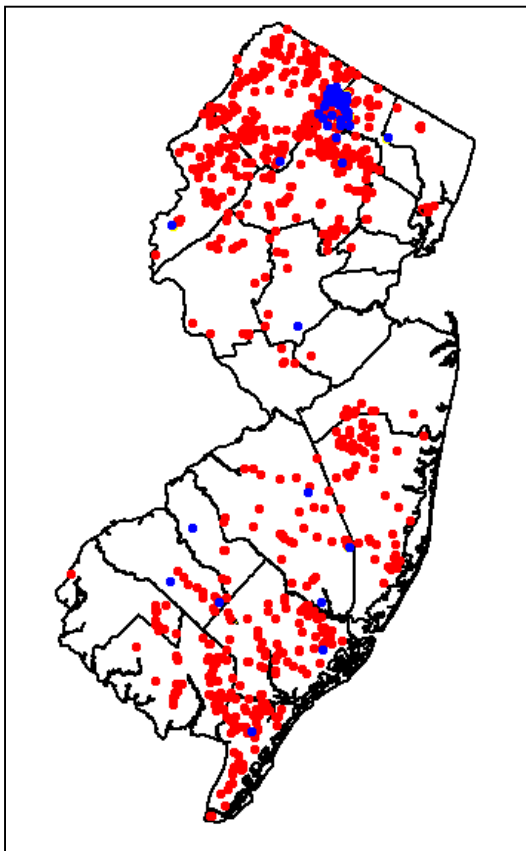


Figure 1. Statewide distribution of owls in NJ (barred, long-eared, short-eared, barn, great-horned, screech, and northern saw-whet owls) as of December 27, 2007 (ENSP's Biotics database); data compiled in 2007 shown in red, data compiled in 2008 shown in blue.

JOB 1L: American Kestrel

OBJECTIVE: To halt and reverse the decline of the newly listed American kestrel through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection, management, research, education and environmental review.

Key findings:

- Suitable sites for American kestrels were identified by using a GIS predictive model based on the NJ Department of Environmental Protection's 2002 Level III Land Use/Land Cover data layer (LU/LC)

and kestrel occupancy data from Dr. Smallwood of Montclair State University. Areas of contiguous kestrel habitat were divided into three patch sizes: 0-250 hectares, 250-1000 hectares, and >1000 hectares.

- Since 2006 more than 275 nest boxes were placed in suitable habitat as identified by the GIS predictive model. ENSP did not reach its goal of 400 boxes due to lack of landowner cooperation to hang the boxes and suitable locations where we did have landowner cooperation. Boxes were concentrated in three major study areas identified as Clinton, Amwell Valley and Assunpink (244 nest boxes) and some placed outside of the study areas (31 nest boxes).
- Below is an updated (and accurate as of 2002 land use/land cover) summary of kestrel habitat within the study sites and nest boxes installed within each of the three patch size categories:

<u>Patch Size</u>	<u># Patches</u>	<u>Total Kestrel Habitat</u>	<u># Boxes</u>
0-250 ha	5,807	43,343 ha	74
250-1000 ha	40	17,998 ha	81
>1000 ha	10	19,633 ha	89

- ENSP expanded the nest box program through collaboration with two new partners, New Jersey Meadowlands Commission (11 nest boxes) and New Jersey Conservation Foundation (19 nest boxes). A total of 30 nest boxes were placed on properties owned by each entity and monitored following the ENSP protocol. No kestrels were observed at either location.
- Of the 275 not all continued to be monitored in the 2008 season, due to a loss of volunteers, lack of landowner cooperation or nest box failure (box broke or the structure the box was attached to fell down). A total of 259 nest boxes were monitored once every 12-15 days from April through August 2008. Of those 259 nest boxes, 50 were occupied by American kestrels. Twenty (40%) boxes resulted in failed nesting by kestrels, while 30 (60%) were successful.
- Nest boxes placed in the top 2 patch categories accounted for the majority (>75%) of active nest boxes throughout the 3 year study.

Study Year	Percentage of Active Nest Boxes in patches >250 ha
2006	84%
2007	82%
2008	78%

- A total of 109 kestrels were banded: 95 young (47 female, 47 male, 1 unknown) and 12 adults (11 female, 1 male) were banded at 33 nest boxes.
 - Two adults were recaptures, one was a female banded last year as an adult at a different nest box and the other was a female from Dr. Smallwood's study area 40 km to the northwest.
- Sixteen failed/addled eggs were collected at 10 different nest boxes.
- A total of nine volunteers checked 78 nest boxes while staff monitored 181 boxes, and over 40 volunteers helped to build boxes.
- All data collected were entered online through a Google documents online interface.
- Due to lack of staff, ENSP was unable to investigate the use of a GIS operation (cost distance) that will help build a predictive foraging habitat model.

Conclusions:

- Nest box placement has been successful allowing us to determine the patch size we should prioritize for kestrel management and we now know the patch size on which we should focus.
- Volunteers are needed and serve as an important component to collect data. ENSP must work on maintaining volunteer relationships because we do not have the resources to allocate staff to monitoring.
- Banding chicks and adults provides good baseline data. These data may fill in data gaps of dispersal.

Recommendations:

- Continue to monitor kestrel nesting in ENSP study sites to determine occupancy (by kestrels and competitors), kestrel productivity, and causes of mortality and nest failures.
- Continue to install nest boxes in the largest patch size to maximize use by kestrels; evaluate effectiveness of nest box program (to kestrel reproductive success).
- Continue to target areas (preserved farmland, state owned land and lands enrolled in conservation programs) that are not in jeopardy of development pressure.
- Recruit and train a group of dedicated Citizen Scientist volunteers to monitor nest box activity throughout the breeding season.
- Develop adequate funding sources to investigate the cause of failed nesting attempts.
- Develop framework and funding to investigate use of and potential loss of kestrel migration habitat.
- Develop survey protocols to determine habitat use by kestrels to be used in environmental review process.
- Develop a radio telemetry study to accurately define kestrel home ranges and their relationship to patch size and habitat quality.

JOB 1M: Secretive Marsh Birds

OBJECTIVE: Develop and implement a monitoring program for secretive marsh birds.

Key Findings:

- The Landscape Project (Landscape) was used as a starting point to determine where survey routes should be located within the Highlands Region and Meadowlands area. The paucity of secretive marsh bird models in Landscape meant that there was not enough information to inform an approach based solely on prior sightings. A habitat model was created from Landscape and used in conjunction with extensive advice from local birders that were highly experienced with secretive marsh bird species.
- Although the Highlands and Meadowlands have political boundaries, covering the entire range of each was not a realistic goal with ENSP's limited staffing resources. Due to this limitation, this survey focused on areas that were deemed to represent suitable habitat for secretive marsh birds, based on an examination of NJ Department of Environmental Protection 2002 Level III Land Use/ Land Cover data (LU/LC) overlaid on aerial photographs and soliciting information from local birders.
- Fifteen routes were created throughout the Highlands Region of the state. Each route had 9-11 survey points, located a minimum of 0.25 miles apart. Most of these routes and survey points were determined through a combination of GIS mapping and contacts with local birders who had knowledge of where secretive marsh birds were likely to occur.
 - Volunteers surveyed nine of the fifteen routes.
 - Volunteers were recruited through a number of sources, including list serves and e-mail solicitations to the Division of Fish and Wildlife's Wildlife Conservation Corps.
 - During the ENSP's 2007 survey, the experience of volunteers was lower than expected. This survey requires volunteers to possess a high degree of skill in audio identification of bird calls. Due to the difficulties with a lack of volunteer experience, a different approach was utilized to obtain volunteers for the 2008 survey. A small, core group of five volunteers was interviewed and selected based on experience and the time that they could commit to the project. In some cases staff conducted surveys to ensure that they were completed.
 - Two ENSP biologists surveyed six of the fifteen routes.
- The Meadowlands portion of the secretive marsh survey did not occur this year due to the lack of staffing in that region. In addition, the New Jersey Audubon Society had conducted an independent Secretive Marsh Birds survey in that region during 2007.
- A one-day training session was conducted to review the protocol with volunteers, carry out distance estimation exercises, and to distribute datasheets and equipment to the volunteers.

- Surveyors followed the Conway protocol, the standard recommended in the Coordinated Bird Monitoring protocols, which requires passive listening as well as call-back portions of the survey. Conway supplied digital files of the focal species' calls. The equipment that was available for this survey included compact disc players and MP3 players. The files were downloaded to the appropriate media with no problems, although the MP3 players performed slightly better than the compact disc players. Calls were amplified using speaker boxes at a decibel level of 90 decibels at 1 meter in front of the speaker.
- This year's survey yielded extensive results. For the 15 routes/149 points surveyed there were a total of 120 responses from Virginia Rails (58 individuals), Sora Rails (9), Least Bitterns (7), American Bitterns (2), King Rails (7), and Common Moorhens (25). There were no responses from Clapper or Black Rails.
- At the time of this report we were still awaiting data for 3 routes/30 points that had not been received.

Conclusions:

- The Conway protocol worked well, especially relating to the information on how to conduct the actual survey. It was not as useful in determining where the survey routes should be located. This is because the Conway protocol focuses on discrete areas (such as a national wildlife refuge) where the survey goal is 100% coverage.
- GIS tools provided a good starting point for determining where routes should be located. Surveying local birders and ground truthing were also important components to determine route locations. The combination of these three, as well as knowledge of the region by the coordinator, is the best way to create routes.
- The training day was necessary to ensure that all volunteers followed the protocol and conducted the survey in the same way.
- The new approach to volunteer recruitment greatly improved the skill level of volunteers participating in the project and in turn greatly increased the overall effectiveness of the survey.

Recommendations:

- Create new routes that may be harder to access, but could be more likely to garner responses from the focal species. Continue to use an integrated approach based on knowledge from local birders and GIS tools to create future routes.
- Continue recruitment and ensure retention of highly skilled volunteers.
- Continue to focus on those sites that are not otherwise protected by state and federal regulations to ensure that vulnerable habitat is identified and protected.
- Utilize this year's results to refine the habitat model utilized to select survey locations and reduce the number of sites surveyed that lack suitable habitat.
- Work with NJ Audubon Society to obtain their 2007 survey data within the Meadowlands area and incorporate their findings into the Landscape Project and future habitat model development.
- Adjust the survey protocols in order to better detect Black Rails.

JOB 2: Species of Special Concern

OBJECTIVE: To conserve populations of birds having Special Concern status in New Jersey, and prevent declines that would necessitate listing through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review.

JOB 2B: Scrub-shrub/Open Field Passerines

OBJECTIVE: To stabilize and reverse the decline in scrub-shrub/open-field nesting birds of special concern and regional priority, both those that migrate through New Jersey and, in particular, those that breed in NJ. Goals include: inventorying and monitoring species populations, (specifically those not covered by the Breeding Bird Survey), the identification and preservation of critical habitat, the identification of specific threats at these sites, and the provision of guidance/recommendations to landowners. Continue work from 2006-07 to determine the characteristics of source habitat for golden-winged warblers occupying utility ROWs in New Jersey as well as GWWA response to certain management techniques used by the utility companies.

Key Findings:

- A statistician was contracted to perform statistical analyses on the golden-winged warbler habitat data and identify habitat parameters that indicate characteristics of source habitat for golden-winged warblers.
 - Results of logistic regression analyses demonstrated a model with 12 parameters that could predict golden-winged warbler habitat with 75% accuracy, 8 parameters that could predict golden-winged warbler source habitat with 93% accuracy, and 12 parameters that could predict blue-winged warbler non-habitat with 71% accuracy. Therefore, additional data collection was not needed for analyses.
 - Golden-winged warbler occupancy – Tree cover, right-of-way (ROW) width, distance to wetland, distance to urban, distance to major road, distance to paved road, and May average low temperature all had a positive relationship. Dead vegetative cover, vegetation height, upland/wetland site, May rainfall, and May average high temperature all had a negative relationship.
 - Golden-winged warbler nesting success – ROW width, distance to major road, distance to paved road, and May rainfall had a positive relationship. Dead vegetative cover, distance to agriculture, June rainfall, and average high temperature in April had a negative relationship.
 - Blue-winged warbler occupancy – Dead vegetative cover, upland/wetland site, ROW width, distance to wetland, distance to agriculture, distance to paved road, and average high temperature in May had a positive relationship. Shrub cover, distance to urban, distance to major road, average high temperature in June, and average low temperature in May had a negative relationship.
- John Confer was unwilling to share data from his work with golden-winged warblers in NY state to pool with our data in the analyses due to publishing conflicts, but we did not need additional data for analyses.
- Outside of timing restrictions, habitat management recommendations were not created because the analyses were just recently completed.
- In 2008, biologists surveyed 406 points for golden-winged warblers in potential habitats (utility ROW, shrub swamp, old field) in northwestern NJ to aid in the identification of priority areas for golden-winged warbler management. Habitat data were collected in 405 of the 406 survey points.
 - Approximately half (48%) of the points were in predominately wetland habitat, 42% of the points were in predominately upland habitat, and 9% were in a mixture of upland and wetland habitats
 - Of the points in wetland or both habitats: 11% occurred in successional forests, 10% in fens, 9% in utility ROWs, 9% in beaver wetlands (Fig. 2B-1).
 - Over 80% of the survey points (362) contained <50% tree cover, with the majority of those (203) containing <25% tree cover (Fig. 2B-2).
 - About 60% of the survey points (250) contained <50% herbaceous cover with the majority of those (139) containing 25-50% herbaceous cover (Fig. 2B-2).
 - About 76% of the survey points (310) contained <50% shrub cover with the majority of those (168) containing 25-50% shrub cover (Fig. 2B-2).
 - Over 90% of the survey points (372) contained <25% dead vegetative cover with the majority of those (273) containing no dead vegetative cover (Fig. 2B-2).
 - Thirteen golden-winged warblers, 2 hybrids, and 104 blue-winged warblers were observed during the 2008 survey.

- All 13 golden-winged warblers were observed on protected lands (state parks, state wildlife management areas, count parks, city watersheds, NGO properties)
- Of the 13 golden-winged warblers observed: 9 (69%) were in utility ROWs, 3 (23%) in successional forest wetlands, and 1 in a shrubby field.
- Of 12 golden-winged warbler locations (2 golden-winged warblers were observed in the same location): most were in wetland ROWs and wetland successional forest (Fig. 2B-1).
- All golden-winged warblers were observed in areas with <50% tree cover (Fig. 2B-2).
- Most of the golden-winged warblers were observed in areas with 25-50% herbaceous cover, 25-75% shrub cover and <25% dead cover (Fig. 2B-2).
- Cooperation with land managers and utility companies has been limited to advising on timing restrictions for management in areas where golden-winged warblers occur on utility rights-of-way because the habitat management recommendations have not been created.
- The Golden-winged Warbler Working Group was idle this past year and will meet in October 2008. However, discussions of golden-winged warbler management occurred at the Appalachian Mountain Joint Venture meeting August 28-30 in Knoxville, TN. The golden-winged warbler was chosen as the species in the region in need of the most attention and a scrub-shrub habitat committee was formed to determine how to strategically create scrub-shrub habitat within the region to benefit golden-winged warblers while not negatively impacting other important forest species.
- The data will be submitted for entry into the Biotics database by mid-October.

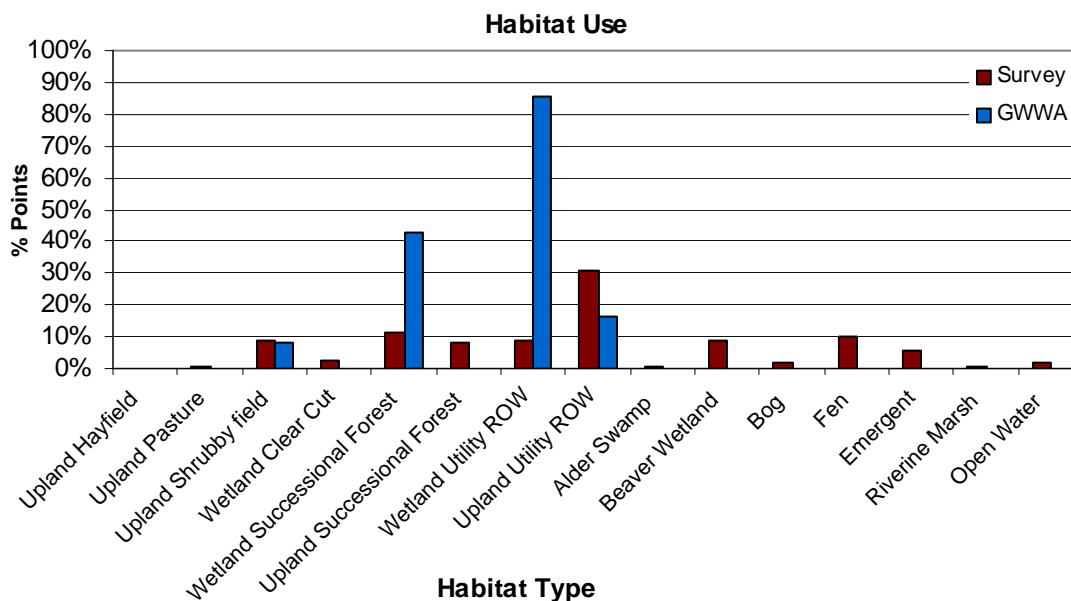


Figure 2B-1. Habitats used by golden-winged warblers during the 2008 survey vs. available habitat surveyed.

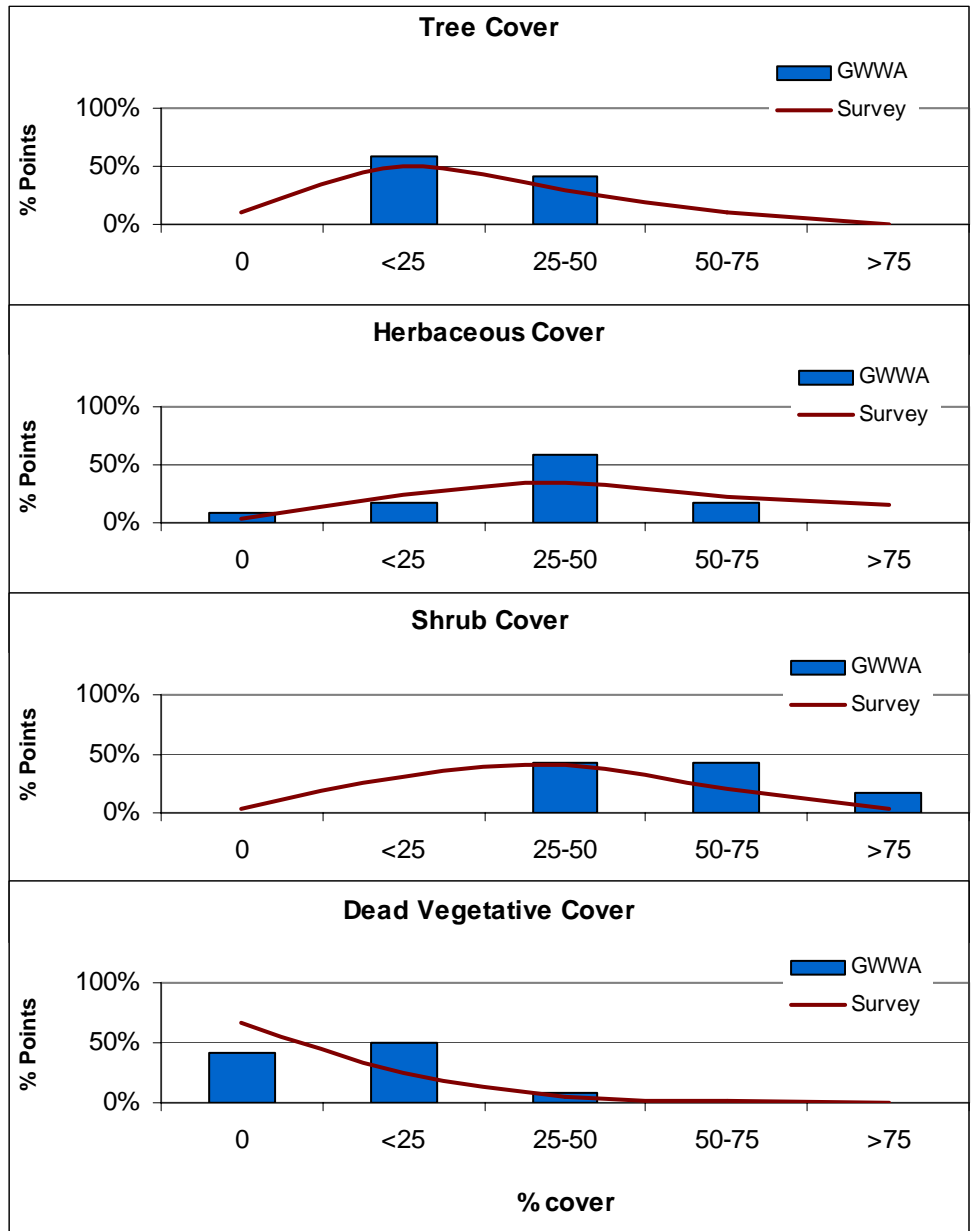


Figure 2B-2. Percent cover type used by golden-winged warblers vs what was available

Conclusions:

- Although habitat exists in NJ for golden-winged warblers, the population continues to decline.
- The results of the 2008 survey demonstrate an affinity by golden-winged warblers for wetland ROWs and wetland successional forests.

Recommendations:

- Go through a single-species Delphi process status review to evaluate possible listing of the golden-winged warbler as state endangered to aid in protecting the remaining golden-winged warbler active breeding sites in the state.
- Create management recommendations for source golden-winged warbler habitat based on the analyses of 2003-2007 data and in coordination with the Golden-winged Warbler Working Group.

- Work with utility companies, NJ Division of Parks and Forestry, NJ Division of Fish and Wildlife’s Bureau of Land Management, Morris County Park Commission, and The Nature Conservancy-New Jersey Chapter to manage the last remaining active golden-winged warbler breeding areas.
- Work with land managers to use the best methods for maintaining optimal golden-winged warbler habitat in areas where individuals have already nested without displacing those individuals by severely altering the habitat.

JOB 2C: Monitoring Avian Productivity and Survivorship (MAPS)

OBJECTIVE: To provide data to the Institute for Bird Populations that will help describe temporal and spatial patterns in the vital rates of target species. Identify the causes of population declines, formulate strategies to reverse declines and maintain healthy populations, and evaluate the effectiveness of the strategies.

Key Findings:

- In 2008, two trained volunteers, with assistance from five untrained volunteers, mist-netted in Bear Swamp, Cumberland County for approximately 420 net hours on eight different days from May through August. This is the 15th consecutive year of operation at this station.
 - Ninety-four individual birds of 24 different species were mist-netted, 80 of these were new captures (76 banded) and 14 were recaptures from previous years.
 - The majority of the birds netted were ovenbirds (22), followed by tufted titmice (10), worm-eating warblers (8), wood thrush (7), gray-cheeked thrush (7), Swainson’s thrush (6), carolina chickadees (5), black-and-white warblers (4), and northern cardinals (4).
 - The mean species abundance in Bear Swamp from 1995–2008 was 72.33 (\pm 9.01); mean species richness was 18.00 (\pm 1.35)
 - 2008 had the highest species richness and second highest species abundance since 1995 (Fig. 2C-1).
 - Productivity was the third highest with 25 (27%) of the 94 aged individuals being young fledged from this year (Fig. 2C-2).
- Data will be submitted for entry into the Biotics database by mid-October.
- There was not enough staff available or volunteer interest to add another MAPS banding station in NJ.

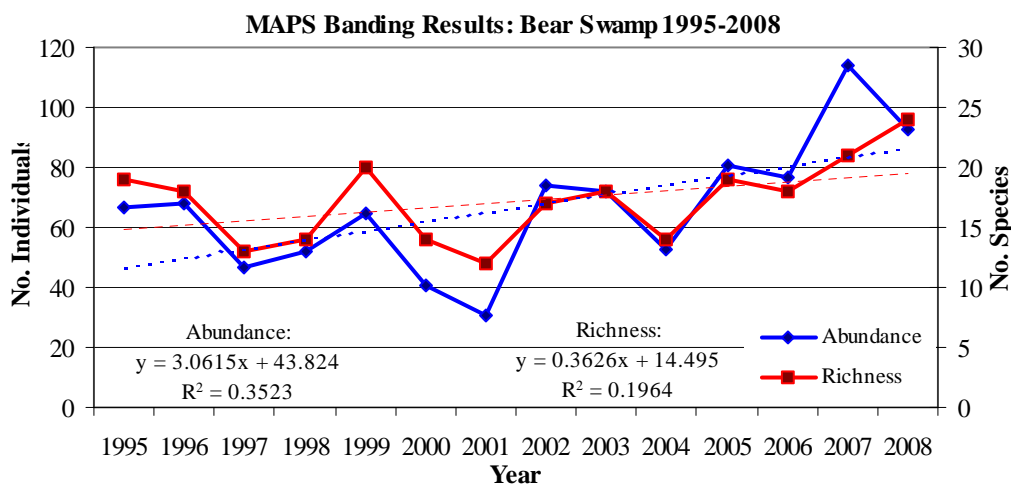


Figure 2C-1. Species richness and abundance at the Bear Swamp banding station from 1995–2008 (1994 banding results were omitted due to inconsistencies/bias of being the first year).

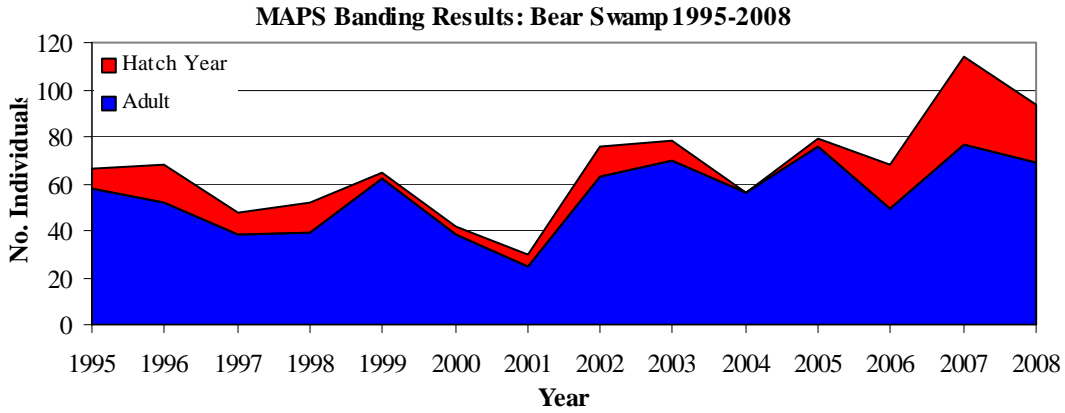


Figure 2C-2. Number of adults and hatch-year birds at the Bear Swamp banding station from 1995 – 2008 (1994 banding results were omitted due to inconsistencies/bias of being the first year).

Conclusions:

- Bear Swamp continues to be a stable community for forest birds. Both species abundance and richness show a positive trend and productivity is relatively high compared with data from 5 – 8 years ago. However, there were more migrants captured this year (gray-cheeked thrush, Swainson’s thrush) than any other year, thus reducing the abundance of breeding birds to 81, which is consistent with the past 3 years of data.

Recommendations:

- Continue the long-term monitoring project and supplement the Institute for Bird Populations with data. Possibly compare this data with trends from other forest songbird surveys.

JOB 3: Species of Regional Priority

OBJECTIVE: To monitor and conserve populations of birds having a Regional Priority status in the northeast, and prevent declines that would necessitate listing.

JOB 3A: American Oystercatcher

OBJECTIVES: Determine statewide distribution of wintering and nesting populations of American oystercatcher (*Haematopus palliatus*), threats and protection strategies.

Key Findings:

- As in 2007, American oystercatcher breeding surveys were conducted in 2008 at all Atlantic coast barrier island beach strand sites, with the exception of Little Beach Island, an isolated barrier island that is part of the Edwin B. Forsythe NWR. Surveys were completed in conjunction with piping plover breeding surveys (conducted at least 3 times weekly) and through research projects conducted by Rutgers University.
 - 59 nesting pairs were identified at 19 beach nesting sites.
 - Less than one-fifth (17%) of the beach nesting pairs hatched young.
 - Productivity was 0.17 chicks fledged per beach nesting pair.
 - Flooding and predation were the primary causes of nest failure. Although the exact causes of failure varied by site, a major Mother's Day nor'easter flooded the majority of nests (statewide) and was a defining factor in the low reproductive success recorded this year.
 - Champagne Island, a small predator-free island within Hereford Inlet, which contributed a significant number of the successfully fledged beach nesting oystercatcher chicks in the previous two breeding seasons, did not produce any chicks this year as a result of flooding and loss of suitable nesting habitat due to the Mother's Day nor'easter.
 - Nearly all the chicks that fledged in 2008 from barrier island beach strand habitat came from one site (Holgate).
- In addition to the comprehensive surveys of oystercatchers found in beach nesting habitat, 110 other pairs of oystercatchers were surveyed less frequently at targeted back bay and inlet breeding concentration areas.
 - Breeding success was extremely low in nearly all these locations primarily as a result of the flooding due to the Mother's Day nor'easter.
 - Notably, nearly all the pairs that did hatch or fledge young (where fledge data is available) in the non-beach habitat were on dredge islands (notably Gull and Pelican Islands near Island Beach State Park) – this may be because artificial dredge islands are typically higher in elevation than other marsh/beach sites so these sites avoided some of the major impacts of flooding that occurred this year.
- A survey of wintering oystercatchers, targeting inlet areas from Sandy Hook to Cape May (Canal Inlet, was conducted December 10-18, 2007. The surveys were conducted by ground (or watercraft) within an hour of high tide to determine the total number of birds present, the ratio of adults and juveniles, and the presence of banded individuals. Similar ground surveys were conducted in December 2004, 2005, and 2006. Aerial surveys of the coast were conducted during the same general time period in 2002 and 2004.
 - A total of 617 birds were counted during the 2007 winter survey, nearly the same as the 2006 winter survey (636).
 - A total of 9 high tide roost flocks were identified during the 2007 survey, the largest being within Hereford and Absecon Inlets.
 - Hereford Inlet hosted the largest number of birds (307) during the December survey. The location of the birds varied slightly within the inlet during the survey period and typically they were in one large flock, however, on the date of the actual survey they were split

- between two locations within the inlet: Champagne Island (189 birds) and North Wildwood (118 birds).
 - A total of 200 individual birds were located at the Absecon Inlet roost site.
 - The Absecon and Hereford Inlets hosted the vast majority (82%) of the state's wintering population in 2007.
 - None of the other flocks were larger than 50 individual birds.
 - For the third year in a row, additional ground surveys were also conducted later in the season (January 9-16, 2008 and February 7-15, 2008).
 - Significantly fewer birds were found during the January and February surveys, in particular in February when a two-thirds reduction in birds (compared to the December survey) was recorded.
 - The Absecon Inlet flock remained fairly consistent in size throughout the entire period (200, 255, 210 during the December, January, and February surveys, respectively) and accounted for nearly all the birds present statewide in February.
- Thirty four (34) oystercatchers, including 25 adults and 9 juveniles, were marked with color (orange) bands during the breeding season following protocol established by the American Oystercatcher Working Group and consistent with other states along the Atlantic coast. Adults were captured using decoys and noose-carpets (McGowan et al, 2005) placed near nest scrapes on breeding territories. Juveniles were captured with a dip net or by hand just prior to fledging. In addition, 6 oystercatchers, all adults, were captured during the fall migratory period with a cannon net and marked with color bands. This brings the total number of oystercatchers banded in New Jersey since 2004 (when the banding program began) to 163 individuals.
- Resighting of banded individual oystercatchers is ongoing and is being conducted by ENSP, Rutgers University, various state agencies along the Atlantic coast, the American Oystercatcher Working Group, and the public. Resighting data for all oystercatchers banded in New Jersey since 2004 were collected and summarized in the previous grant period ending August 31, 2007, however, the database has been updated to include more recent resightings. Prior to this grant period, 756 resightings of New Jersey bands have been recorded, including 698 from in-state and 58 from out-of-state. An additional 67 resights were recorded during this segment, bringing the total reported to 823.
- The development and testing of a predictive population model to help identify critical breeding locations and assist in population viability analysis was completed during the previous segment (ending 8/31/07). A discussion of the model and the results of the survey to test the model were included in the report previously submitted for that segment.
- It is critical to establish uniform protocols within New Jersey for annual breeding surveys of oystercatchers as many different agencies and groups are part to the overall state monitoring effort. With the assistance of Rutgers University, which has been heavily involved in oystercatcher research since 2004, revised breeding survey protocols, data sheets, and band resighting protocols are currently in the final phase of development and will be in place prior to the next breeding season.
- Detailed comments were submitted through the American Oystercatcher Working Group regarding the final version of the American Oystercatcher Conservation Plan for the Atlantic and Gulf Coasts of the U.S. (November 2007). As part of a secondary related effort, comments were provided to the Working Group for an American Oystercatcher *Business Plan*, which was developed for the National Fish and Wildlife Foundation and provides the framework for a ten-year multi-state conservation effort, including specific budget needs, along the entire Atlantic Coast.
- An assessment of threats and implementation of management strategies to protect breeding oystercatchers is ongoing. Nearly all the known Atlantic Coast beach strand breeding sites (17 of 19) in 2008 were posted with "warning" signs and protected with "symbolic" post and string fence to minimize human disturbance. Threats vary from site to site and are typically assessed jointly with those affecting other beach nesting birds (i.e. piping plover, least tern, and black skimmer) that typically nest near oystercatchers on barrier beach sites. Over the past several years in conjunction with the U.S. Fish and Wildlife Service–New Jersey Field Office, beach management plans, which comprehensively address all known and potential threats, have been developed with a dozen municipalities or other coastal landowners hosting beach nesting birds. Several additional plans are

also being proposed. Initially these plans focused only on state or federally listed (T&E) species, thus oystercatchers were not included, but given that they share the same habitat and threats and their current level of conservation concern, oystercatchers are now fully integrated into the plans.

- A study regarding the relationship between the foraging dynamics and productivity of oystercatchers at the foraging areas of important breeding sites was not conducted due to limited resources.

Conclusions:

- The number of breeding pairs of oystercatcher (59) on barrier/beach strand (beach nesting portion of the population) in 2008 was near average for the period since 2003 when comprehensive monitoring began (59 pairs) and nearly identical to the previous three years (60, 59 and 59 in 2007, 2006, 2005, respectively).
- Pair hatch success for beach nesting oystercatchers was down in 2008 (17% of pairs hatched young) compared to the average for the period since 2003 (24%). One exception was Holgate, where nearly half of the pairs hatched young. The hatch success at that site may have, in part, been the result of the use of experimental predator exclosures (similar to those used for piping plovers).
- Productivity for beach nesting oystercatchers in 2008 was the lowest (0.17 fledglings per pair) since intensive monitoring began in 2003 and below the average for the period (0.25 fledglings per pair). Such low productivity is cause for concern, although it may be compensated somewhat by the fact that oystercatchers are such a long-lived species. Brood success was relatively higher (1.00 chicks were fledged per pair that hatched young), which suggests that management efforts that improve hatch success even slightly may produce significant increases in productivity.
- Of the pairs monitored outside of beach habitat, breeding success has widely varied by year, habitat type, and site, but reproductive success was more uniformly poor this year, to a large degree because of widespread flooding during the Mother's Day nor'easter.
- Although the state's wintering population (during the December survey period) was very consistent the past two years, it has varied since 2002-03 when surveying began. Reasons for the variability in the state's wintering population are still not clear, although the fact that the number of birds present becomes significantly lower in January and February suggests weather is a major factor. The specific high tide roost locations used within the state have remained very consistent across all survey years. Roosts within Absecon and Hereford Inlets are clearly the most significant in NJ in terms of the number of birds present. The Absecon Inlet roost location (Rum Point and/or westernmost beach along Brigantine Cove) is particularly important as it has consistently hosted a large number of birds throughout the entire winter period, whereas other locations, including Hereford Inlet, have fluctuated more widely (or have not been used later in the winter as birds have apparently dispersed from the state).

Recommendations:

- Continue to monitor breeding population and productivity of beach nesting oystercatchers on an annual basis. Continue to monitor population and productivity of oystercatchers at other important breeding sites, including Hereford Inlet, Holgate, Island Beach/Sedge complex, and other high density breeding areas, as resources are available.
- Continue to track wintering population and distribution annually. Expand survey to include the fall period, where possible, perhaps in conjunction with other shorebird surveys already in effect.
- Conduct a statewide breeding survey across all habitat types along the Atlantic coast and Delaware and Raritan Bays sometime in the next several years. If practical, surveys should be coordinated with other Atlantic coast states to also help determine regional and/or range wide populations.
- Continue efforts to mark (band) oystercatchers as part of an Atlantic coast initiative to track and study movements of birds and gather other key demographic data.
- Continue including oystercatchers in management efforts (i.e. fencing and posting, predator control) at sites where other beach nesting birds (i.e., piping plover, least tern, black skimmers) are present. Continue including oystercatcher conservation in beach nesting bird management plans being developed for barrier island municipalities and other sites.

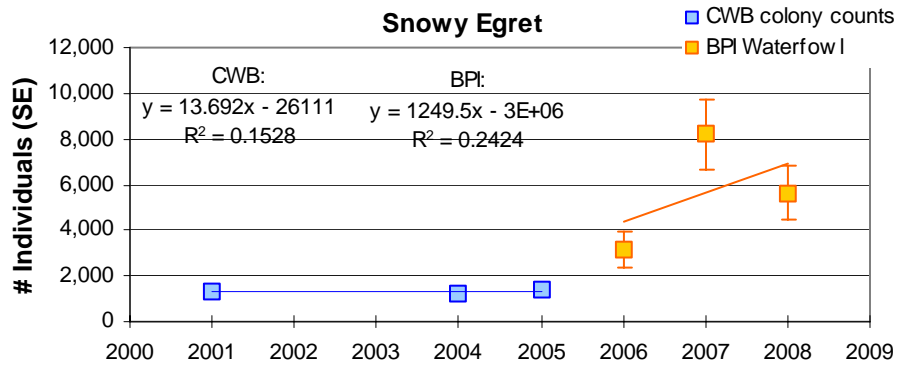
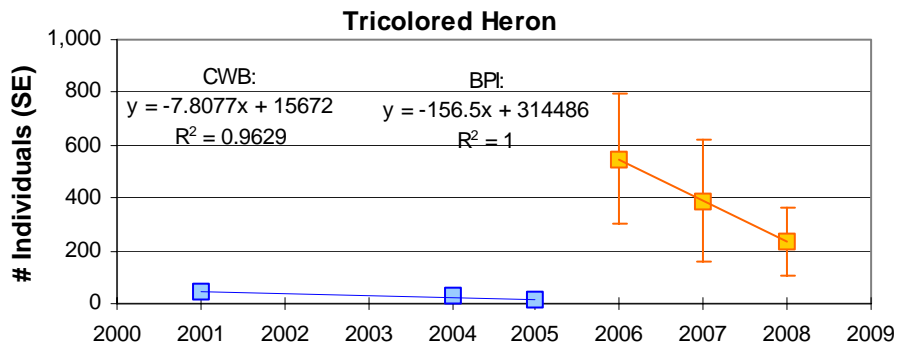
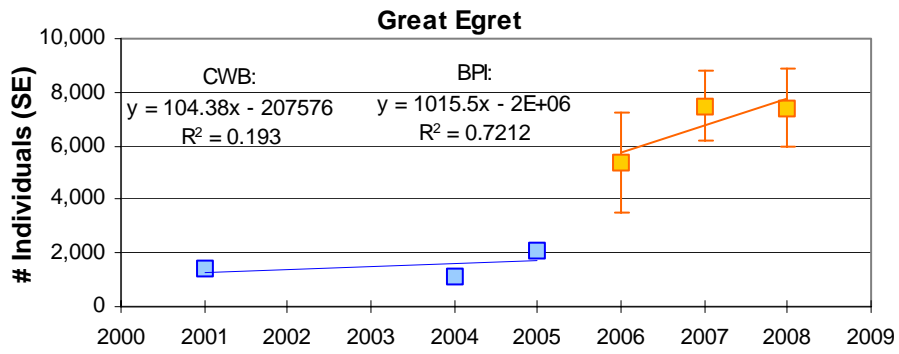
- Include oystercatcher breeding sites and wintering roost locations as part of regulatory reviews and other environmental assessments, including in designation of critical wildlife habitat in the coastal zone. Consider inclusion of critical foraging areas in regulatory process as well, although this may require additional research to help identify areas and to demonstrate importance of protecting them.
- Continue working with the American Oystercatcher Working Group and using the American Oystercatcher Conservation Plan for the Atlantic and Gulf Coasts of the U.S. and New Jersey's Wildlife Action Plan to help direct monitoring, management, and research efforts within the state.
- Continue to incorporate breeding and wintering data into Biotics and Landscape Project databases.

JOB 3B: Regional & National Bird Coordination

OBJECTIVE: To continue active participation in regional/national meetings, planning, and surveys including the Breeding Bird Survey, Coordinated Bird Monitoring, Partners in Flight, and other working groups pertinent to bird research.

Key Findings:

- In 2008, 26 out of 28 of the USGS Breeding Bird Survey (BBS) routes in New Jersey were assigned and 25 were surveyed.
- A biologist from NJ Division of Fish and Wildlife (NJ DFW) attended the Northeast Coordinated Bird Monitoring Workshop Oct 3-5 in Laurel, MD and participated in break-out groups for grassland birds, scrub-shrub birds, and forest birds.
- Biologists from NJ DFW attended the Atlantic Coast Joint Venture meeting July 20-23, 2008 in Princeton, NJ.
- A biologist from NJ DFW attended the Appalachian Mountain Joint Venture (AMJV) meeting on August 18-20, 2008 in Knoxville, TN.
 - Participants of the AMJV decided to create a partnership with Alianza Regional de Chiapas. An oversight committee was formed to create guidance for this partnership and identify target species in common with AMJV and Alianza.
 - A monitoring committee was formed to identify/prioritize monitoring needs, develop coordinated monitoring projects/protocols/databases that will help inform Alianza and AMJVs in biological planning (e.g., establish habitat and population objectives), etc.
 - The golden-winged warbler was chosen as the species in the region in need of the most attention. A scrub-shrub habitat committee was formed to determine how to strategically create scrub-shrub habitat within the region to benefit golden-winged warblers while not negatively impacting other important forest species.
- As part of the NJ Coordinated Bird Monitoring Plan, biologists from NJ DFW collaborated for the fourth year to conduct a joint waterfowl BPI and E&T waterbird survey.
 - A biologist from NJ DFW presented the first three years of data to the Northeast Fish and Wildlife Conference in April 2008.
 - A total 57 state endangered or threatened and 116 state special concern species were observed with 76 new locations in 2008
 - Trends can be detected in the saltmarsh strata for great egrets, snowy egrets, tricolored herons, little blue herons, and black-crowned night-herons (Fig. 3B-1)
 - Trends from the BPI cannot be accurately compared with results of the colonial waterbird surveys until data from the next waterbird aerial survey are ready.
 - Data will be submitted for entry into the Biotics database by mid-October.



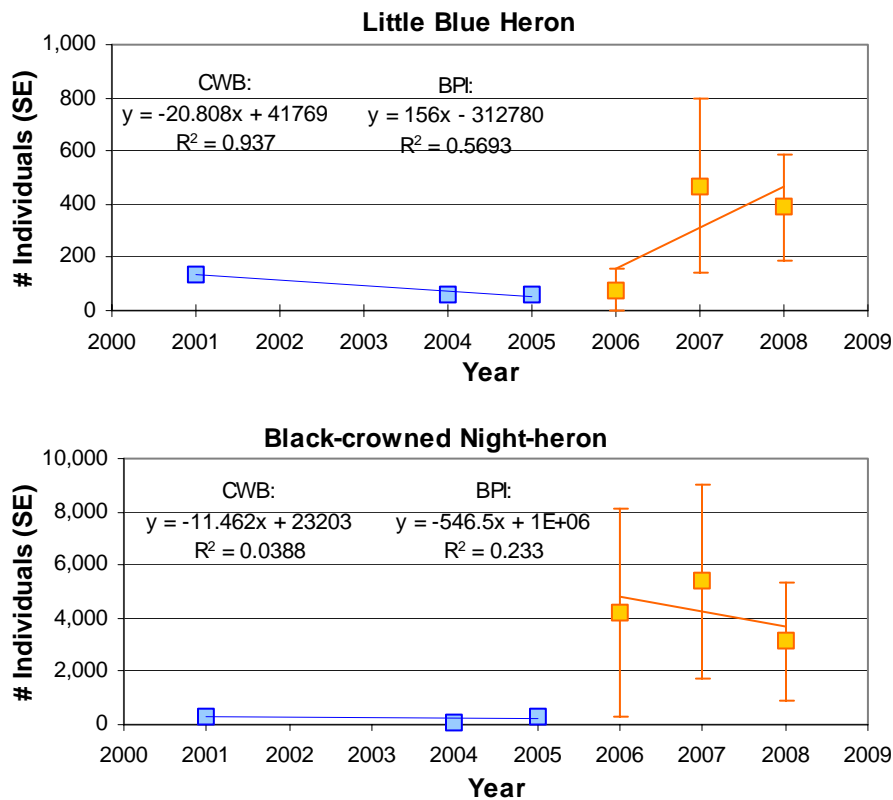


Figure 3B-1. Trends of the BPI waterfowl surveys, 2006–2008 (yellow), and the colonial waterbird aerial colony count, 2001–2005 (blue). The year 2005 was dropped from the BPI waterfowl survey due to first-year bias.

Conclusions:

- Collaboration with other states and regions is critical for large-scale bird monitoring and should be a high priority for the state of New Jersey.
- Collaborating waterfowl and waterbird surveys within state provides results and should be continued at least a few more years to compare trends.

Recommendations:

- Continue to collaborate on waterfowl and waterbird surveys in NJ and analyze the efficiency of the survey protocol at estimating trends and population indices of waterbirds in NJ when the data become available.
- Continue to participate in the Northeast Coordinated Bird Monitoring Working Groups and other regional coordination efforts.

JOB 4: Migratory Stopover Research and Planning

OBJECTIVE: To identify, monitor, conserve and improve key migratory corridors and stopover locations for migrant land birds that each spring and fall stop in New Jersey seeking food, cover and water.

JOB 4A: Oases Along the Flyway: Critical Stopover Habitat for Migrating Songbirds in the Northeast

OBJECTIVE: The goal of this project is to refine management strategies that help conserve stopover habitats used by songbirds as they travel through New Jersey during north and southbound migrations using migration data. Specifically, our objectives are to: (1) identify specific areas that support high concentrations of migratory songbirds during stopovers in New Jersey, (2) link areas identified as important stopover sites with specific habitat types, and (3) assess how landscape features (e.g., size of habitat, distance to similar habitat, fragmentation) affect which areas are used by migrants.

Key Findings:

- NJ Audubon Society (NJAS) was contracted to continue to collect bird migration data using the National Weather Service's Doppler weather surveillance radar system, WSR-88D.
- NJAS collected 124 nights of data during fall 2007 and 68 nights of National Weather Service Doppler radar data during spring 2008 from Dover Air Force Base, DE (DOX) and Philadelphia, PA (DIX) radar stations to monitor bird migration events in southern and central New Jersey respectively.
- A review of data from spring and fall 2007 to assess nights when nocturnal migration events (MIG) occurred revealed that approximately 38% of all data [reviewed] were classified as MIG. A more conservative review resulted in approximately 16% of the data being used in analyses of stopover abundance and occupancy. Precipitation and uncertainty about the nature of the entities detected by the radar (e.g., insects) during migration departure were reasons for not including certain nights of data in analyses. This is the same approach NJAS is using in studies of other mid-Atlantic areas.
- At the time of this report NJAS was analyzing the spring and fall 2007 data to build station-specific stopover occupancy models from migration departure data by creating two composite outputs: (1) total bird density during departure across all migration nights for each 1 x 1 km cell (spatial resolution of NEXRAD data) and (2) number of migration nights birds were detected during departure in each 1 x 1 km cell (i.e., frequency of bird occupancy). The two outputs will be used to produce stopover occupancy (SO) models. NJAS will also identify stopover areas outside the SO models (non-SO models) but within 30 nm (DIX) or 45 nm (DOX) from the radar stations.

Conclusions:

- Radar data collected during the period when landbirds are departing on nocturnal migration continue to be useful for delineating areas that are important during stopover periods.
- These data used in conjunction with land use/land cover data provide important information about habitat and landscape patterns that underlie distribution and abundance of landbirds just prior to migration departures
- Spatial correspondence among station- and season-specific SO models is relatively high (~60-75%, depending on season and station) among years, suggesting that the habitat management actions targeting these areas could provide long-term conservation benefits for migrating landbirds.

Recommendations:

- Complete analyses of spring and fall 2007 data and submit final report.
 - Investigate relationships between stopover site occupancy and habitat and landscape features.
 - Extract seven landscape metric values for twelve land cover classes using "class metrics" in Fragstats 3.3 (Build 4, McGarigal and Marks 1995).
 - Explore differences in SO and non-SO model GRIDs by station for each land cover class considered by using PROC GLM routines in SAS© (Version 9.1.3).
- Import stopover area threshold model data in Landscape Project to evaluate overlap with areas designated as high rank patches for endangered, threatened and conservation concern species.
- Validate SO and non-SO threshold models by using data collected in the field about the relative abundance and occupancy of birds in these areas. Investigate microhabitat variables that are determinates of differential abundance and occupancy patterns. Investigate physiological differences between birds using SO and non-SO areas to determine potential effects on fitness (e.g., survival).

JOB 5: New Jersey's Important Bird Areas

OBJECTIVE: Important Bird Areas seek to conserve sites critical to migratory, wintering and breeding birds internationally, under the direction of National Audubon Society and New Jersey Audubon Society (NJAS). The objectives of the NJ Important Bird Areas are to 1) identify a network of key places (Important Bird Areas, or IBAs) that will help sustain naturally occurring populations of birds and birding sites in NJ, 2) ensure the continued viability of these sites, and 3) to raise public awareness about the value of habitat for birds and other wildlife.

Key Findings:

- NJAS submitted the final IBA boundaries (GIS file and metadata) to the ENSP. IBA boundaries will be “stand-alone” layers in the NJ Department of Environmental Protection’s I-Map application and the ENSP’s Landscape Project mapping. The IBBA Program completed implementation of a GIS methodology for delineating boundaries of IBAs using NJ DEP’s Landscape Project Version 2.1 and 3.0. However, ENSP requested and NJAS agreed to provide IBA boundaries as a stand-alone layer rather than conforming IBA boundaries to Landscape Project patch boundaries. This alleviated a number of technical and regulatory difficulties that arose while integrating the two GIS layers.
- While there were no new sites to nominate during this segment, the IBBA Program updated and refined the IBA inventory and data, and collected monitoring data at provisional IBAs, macrosite IBAs and priority IBAs.
- IBBA Program staff updated the two comprehensive data warehouses: National Audubon’s searchable IBA database and NJAS’s IBBA Program Site Guide. These databases are consistent with attribute tables of IBA boundaries and all are consistent with data submitted to the NJ DEP’s Biotics database (regulatory location data for state endangered, threatened and special concern species).
- Additional opportunities to expand conservation efforts, implement habitat restoration plans and conduct outreach in priority IBAs were identified. These projects are some of the best examples of implementation of the Wildlife Action Plan habitat management and species recovery goals in NJ.
 - Cohansey River Corridor: Conservation plans were developed for several landowners addressing invasive species removal, riparian habitat improvement and wetland restoration. Projects include a two-acre riparian buffer and one-acre pond restoration along Alloway Creek, and a 20-acre phragmites removal along the Cohansey River. A grassland restoration project (approximately ten acres) is pending approval from the USDA’s Wildlife Habitat Incentive Program. Additionally, ten landowners were provided with management recommendations for their properties.
 - Southern Pine Barrens Macrosite: In addition to ongoing forest stewardship projects targeting disturbance-dependent wildlife, we expanded an existing forest management plan to an adjacent landowner, doubling our management area of 140 acres to 300 acres in one project site.
 - Northern Pine Barrens Macrosite: NJAS identified objectives and ecological endpoints with consulting foresters, and we await forest stewardship plans for the Berkeley Triangle Project, encompassing >10,000 acre of public and private land for forest stewardship planning.
 - Mannington Meadows: This year, NJAS expanded a two-mile riparian restoration project in the Mannington Meadows IBA (MMIBA) to an adjacent landowner, an expansion of 25 acres. Demonstration sites set an example for stewardship that landowners in the IBA were enthusiastic to follow. Through a habitat analysis, NJAS identified a 30-acre site, currently in row-crop agriculture, suitable for early successional habitat restoration. Working with a corporate steward, NJAS will plant a mixture of native shrubs and grasses to instantly provide scrub-shrub habitat and increase the time the buffer will be in an early seral stage.
 - Cape Island: NJAS has targeted landowners throughout the Cape May Peninsula in the most critical portion, Cape Island (south of Cape May Canal). Current projects include a wetland restoration adjacent to open space and two native warm season grassland restorations.
- The IBBA Program continued to develop and sustain critical partnerships on conservation objectives at high-priority IBA sites to facilitate regional-scale planning. Partners include Pennsylvania Audubon Society, National Audubon Society, USFWS, Natural Resource Conservation Service, The Nature Conservancy, Pinelands Preservation Alliance, Delaware River Keeper, New Jersey Public Interest

Research Group, Association of NJ Environmental Commissions, New Jersey Conservation Foundation, Trust for Public Land, Delaware and Raritan Greenway, Mannington Preservation Citizens Coalition and the American Littoral Society (ALS). Additional, local, partners were made in the Cohansey River Corridor IBA and the Northern Pine Barrens Macrosite.

- Replicable monitoring protocols, to collect avian and vegetation data at IBAs, were developed and implemented at Southern Pine Barrens Macrosite IBA, Greenwood Forest/ Pasadena Wildlife Management Area (WMA) IBA, Northern Pine Barrens Macrosite IBA, Cohansey River Corridor IBA and the Mad Horse Creek & Abotts Meadow WMA/ Stowe Creek IBA. All Endangered, Threatened and Special Concern (E, T, SC) species data were prepared in compliance with NJDEP mapping and digital data standards and submitted to the Biotics database, (survey results follow in the next bullet).
 - IBBA Program staff conducted avian point count surveys and vegetation monitoring at several priority IBAs in the Delaware Bay and Pine Barrens regions. Avian monitoring was completed in six IBAs:
 - Cohansey River Corridor IBA, the Mad Horse Creek and Abotts Meadow WMA/ Stow Creek IBA (which includes Alloway Creek). Forty-four point count locations were surveyed twice (late May and mid-June); >2,800 individuals were recorded, with 73 occurrences of endangered, threatened and special concern birds (mainly raptors, herons, songbirds).
 - Southern Pine Barrens Macrosite IBA. Fifteen point count locations were surveyed twice (late May and mid-June); 240 individuals were recorded including 19 occurrences of special concern birds (mainly scrub-shrub and forest land birds).
 - Greenwood Forest/ Pasadena WMA IBA (which is contained within the Northern Pine Barrens Macrosite IBA). Nineteen point count locations were surveyed three times (late May, early & mid-June); 650 individuals were recorded mainly scrub-shrub and forest land birds of regional conservation concern.
 - Mercer Sod Farm IBA. Twenty-seven point count locations were surveyed by NJAS volunteers. Eight grassland species were recorded including four endangered and threatened species, two special concern species (one grassland and one scrub-shrub) and six early successional species of regional conservation concern.
 - Vegetation monitoring on seven, 100 m plots was conducted in the Greenwood Forest/ Pasadena WMA IBA and the Northern Pine Barrens Macrosite IBA. Intensive vegetative sampling sites were centered on avian point count survey locations and will serve as a pre-management baseline prior to implementation of forest management

Conclusions:

- The comprehensive, web-based warehouses of data collected on NJ's IBAs, has allowed efficient delivery of accurate and current reports of the state's most important habitats to a variety of stakeholders including members of the community, conservation partners, planners and government agencies. These widely-available resources are a valuable tool to develop and implement successful conservation planning.
- IBA boundaries have been used to guide conservation planning by IBBA Program staff, local and regional planners and partners within priority IBAs.
- Using the IBBA Program model, NJAS will continue to protect rare species through a landscape-based approach; target habitat enhancement opportunities, assist with implementation of NJ's WAP; promote "hands-on" educational activities and volunteer stewardship opportunities; and encourage ecotourism in the state.
- The Adopt-an-IBA Program promotes community involvement in site identification, monitoring and stewardship, awareness of conservation and the importance of wildlife habitat.
- Conservation efforts at priority IBAs are well received by local communities, state and local governments and partner conservation organizations and warrant continued implementation.
- NJAS has made significant progress toward achieving the goals of the IBBA Program. Conservation models have been developed and successfully implemented at several priority IBAs.

- Elements of the WAP are being implemented on-the-ground by working within, and adjacent to, Important Bird Areas; for example, the acreage of land managed for wildlife habitat has increased in southern NJ, and collaboration with adjacent landowners has “grown” conserved land centers and riparian areas providing habitat connectivity and large habitat patches that support metapopulations.

Recommendations:

- New IBA nominations and additional site information should be collected and integrated into the comprehensive inventory of Important Bird Areas in NJ.
- Regularly update NJ’s IBA and National Audubon’s IBA databases and NJAS’s site guide with avian data and site updates obtained from volunteers and monitoring activities.
- Continue annual submission of avian data from IBAs to the Biotics database to inform the Landscape Project and avoid discrepancies between the two databases.
- Continued avian and vegetation monitoring at IBAs will allow for collection of baseline data and assessment of pre- and post-management impacts.
- Update IBA boundaries when Landscape Project Version 3.1 data or new Land Use Land Cover data becomes available. Continue progress toward inclusion of IBA boundaries in NJ DEP’s I-Map and Landscape Project, Version 3.1.
- Continue to encourage community involvement in the protection and restoration of IBAs through participation in the Adopt-an-IBA Program.

EXECUTIVE SUMMARY

Project: Mammal Conservation
Federal Aid Project: T-1-4 (State Wildlife Grants)
Segment dates: September 1, 2007 to August 31, 2008
Total Project Expenditures: \$161,500 (\$121,125 Federal, \$40,375 State)

JOB 1: Federal and State Listed Mammals

OBJECTIVE: To conserve populations of federal and state-listed species through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review.

JOB 1A: Bobcat Conservation

OBJECTIVE: Determine the distribution, size and habitat needs of New Jersey's bobcat population and use the information to preserve the habitat necessary to maintain a viable population.

Key Findings:

- A scent dog-handler team surveyed areas in northern New Jersey with known bobcat locations as well as areas predicted to contain suitable bobcat habitat (using predictive habitat model) but with no known locations. The surveys were conducted between January and May 2008 to gather data on unique individuals to estimate a minimum population size and sex ratio of the bobcat population in northern NJ. Using the 5 km computer-generated grid created in 2007, at least one transect was sampled in each grid cell that contained a known bobcat location or predicted suitable habitat. Approximately 127 transects between 0.5 and 11.5 km were sampled during the study period. We collected 264 scats, of which 98 (37%) were confirmed to be bobcat based on DNA analysis. Twenty-five (9%) of the scats did not contain adequate DNA to determine species identification.
- Staff worked with the U.S. Forest Service Rocky Mountain Research Station lab (Montana) as they assessed samples they had received for the regional genetic variability study aimed at understanding the genetic structure of the New Jersey population. It was determined that the sample size and distribution were not yet adequate to perform the mitochondrial DNA sequencing and analysis. To date, bobcat tissue samples from New Jersey (n=20), New York (n=38), Pennsylvania (n=12), and Maine (n=7) have been genotyped and added to the database. Samples are lacking for the counties in Pennsylvania and New York that border New Jersey. Biologists in New York and Pennsylvania have agreed to collect bobcat tissue samples again this winter, concentrating particularly on the counties bordering New Jersey. Maine has also agreed to collect more samples to increase the sample size. New Jersey will continue to collect samples from bobcat road and trapping mortalities in an effort to obtain an adequate sample size and distribution to complete an analysis in 2009.
- Bobcat observation data from the public as well as our survey efforts over the past 2 years (n=200) have been mapped and tracked in preparation for entry into the Biotics database.
- A training seminar was conducted on January 19, 2008, to instruct volunteers on the proper identification of bobcat tracks. Fifteen volunteers participated in the four-hour training seminar. Sean Grace, a trained expert tracker, conducted the seminar. No volunteers reported sightings of tracks during their survey efforts. However, snow cover and tracking conditions were poor last winter in the period following the training session.
- Six new GPS/VHF collars have been ordered after consultation with other researchers that have had experience using the collars. Due to the past poor performance of the Televilt GPS collars, this aspect

of the project was suspended in an effort to find a suitable replacement collar. The collars will be deployed on adult bobcats during the 2008-09 season.

- Biologists met with members of the NJ Trappers Association and the NJ Fur Harvesters to present the state's research efforts and attempt to get the cooperation of the organizations' memberships to report incidental captures of bobcats during the trapping season. The ENSP has set up a response team to assist trappers in the safe release of incidentally snared bobcats. Response team contact information will be disseminated to trappers prior to the start of the upcoming trapping season.
- Following a relatively unsuccessful initial attempt at using volunteers to set-up and monitor scent stations using motion-sensitive cameras, biologists re-evaluated this survey technique by modifying the protocol. Three locations (within three separate 5 km grid cells) identified by the predictive habitat model as having suitable bobcat habitat, but which lacked bobcat occurrence records, were surveyed using scent stations and motion sensitive cameras. During this survey, only experienced volunteers were selected for establishing and monitoring the scent stations. Sampling density was increased from one to five scent stations and cameras around each sample point within the 5 km grid cells. The duration of time that each scent stations was monitored was extended from 30 days to 90 days. In addition to bobcat urine, three other scent lures were used at randomly selected scent stations to determine their efficacy. A bobcat was captured on film at one of the scent stations within the three grid cells surveyed.
- In preparation for the 2007-08 field season, the dog-handler team worked with the dog trainer from Working Dogs for Conservation in an effort to train the dog off of coyote scat using a new reward method. Also in preparation for the field season the U.S. Forest Service Rocky Mountain Research Station lab agreed to provide a quicker turn-around time for the species identification results as a quality control check.
 - The new reward method was used at the start of the survey period and resulted in a relatively low accuracy rate in the dog alerting to bobcat scat when he detected it, so it was discontinued and the method used in 2007 was reapplied. Nevertheless, the survey effort this year resulted in the completion of nearly three times as many transects as well as bobcat scats collected compared to last year. Bobcat presence was confirmed in several new locations and the data was prepared for entry into the Biotics database. The lab has not yet completed the analysis of the individual identification of the confirmed bobcat scats.

Conclusions:

- The new reward method applied at the beginning of the 2007-2008 field season involved not rewarding the dog in the field, but only in training sessions when it was certain that he was alerting to bobcat scat. It was suggested as a way to not inadvertently train him on coyote scat like had happened during the 2007 season. It was determined early in the 2008 field season, with the help of a quick turn-around time of results from the lab, that the method was not appropriate for the personality of the dog. The no reward was causing him a great deal of stress, which resulted in him trying to eat bobcat scat and then avoiding it altogether. The dog-handler team then regrouped and the dog was again rewarded in the field, which corrected the problem though he did get inadvertently rewarded for some coyote scat as was expected.
- The use of experienced volunteers to establish and monitor scent stations and motion sensitive cameras appears to be one of several effective techniques to survey for bobcats. We will continue to use this as one of the techniques we employ to survey areas for bobcat occurrence.
- It is critical that the lab receive samples from the bordering counties of New York and Pennsylvania as well as from Maine for the genetic variability analysis to be meaningful. We are working with these states to obtain additional samples.

Recommendations:

- Analyze the results of the individual identification of scats when completed by the lab and develop an estimate of the population size and sex ratio in northern New Jersey. Using the dog-handler team, begin surveying areas in central and southern New Jersey where bobcats have been reported in an effort to confirm their presence.
- Continue to use scent stations and motion-sensitive cameras to survey suitable bobcat habitat. Experiment with the use of hair snares and scent lures as an additional technique to identify bobcat locations.
- Work with the U.S. Forest Service Rocky Mountain Research Station lab as they perform the mitochondrial DNA sequencing and analysis for the regional genetic variability study. Work with surrounding states in 2009 to collect more tissue samples if needed.
- Live trap and fit GPS/VHF collars on up to six adult bobcats to obtain additional data on movements, home range size and habitat use in areas of northern NJ where this information is lacking.
- Catch up on the backlog of bobcat locations that need to be entered into the Biotics database. Use the updated dataset to investigate refinement of the predictive habitat model.
- A follow-up training session on bobcat track identification should be conducted annually to serve as a refresher course for those previously trained, and to train new volunteers.

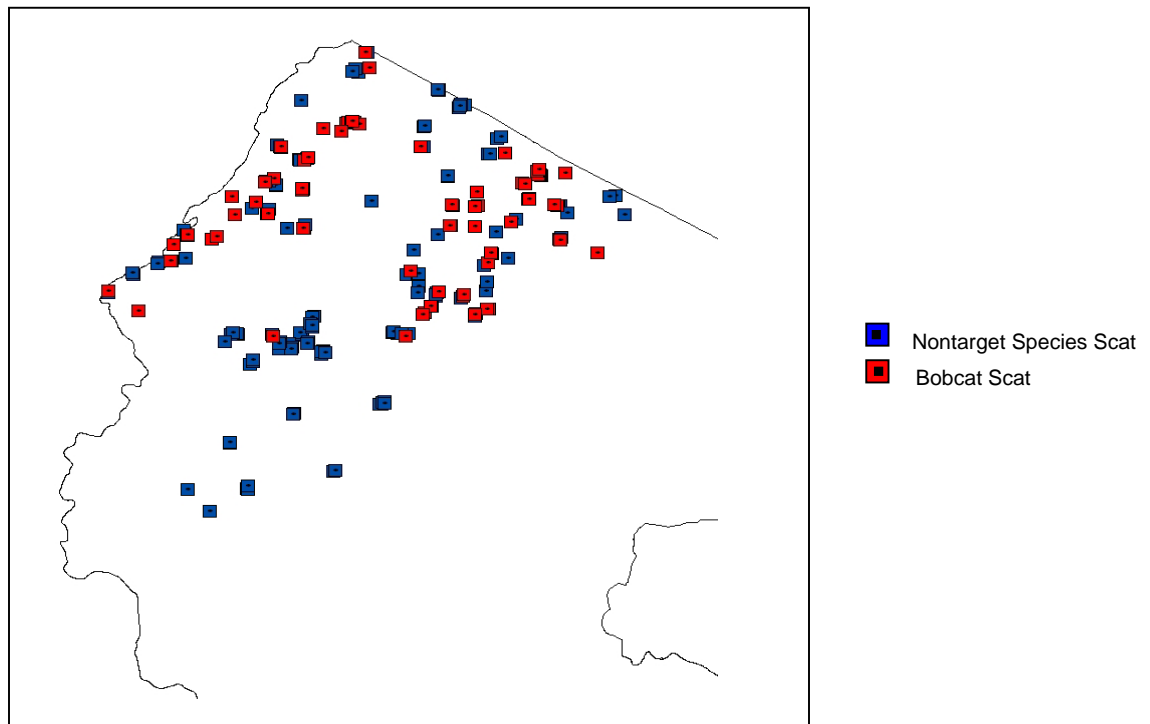


Figure 1. Scats collected using a dog-handler team in northern NJ, January-May, 2008.

JOB 1C: Allegheny Woodrat Conservation

OBJECTIVE: Annually monitor NJ's Allegheny woodrat (*Neotoma magister*) population and assess the potential exposure risk to raccoon roundworm (*Baylisascaris procyonis*). Actively manage raccoon roundworm levels in the raccoon population at New Jersey's last remaining Allegheny woodrat population through the use of medicated raccoon baits.

Key Findings:

- Standard trapping protocol was conducted at six separate talus slope sites at the base of the Palisades Interstate Park on 3-4 October 2007. Tomahawk TM Model 201 (5"x5"x16") Collapsible Single-door Live Traps were used for sampling. The traps were baited with apple slices and peanut butter.
- Forty traps were set for two consecutive days for a total of 80 trap-nights of sampling effort.
- A total of 15 woodrats were captured for a capture index of 1.87 individuals trapped/10 trap-nights.
 - Captured animals consisted of six adult females, three sub-adult females, four adult males and two sub-adult males.
 - Seven (four females and three males) of the 15 individuals captured in 2007 were recaptures from previous years.
 - One adult female was initially captured in fall 2004 at site G, recaptured at site C in 2005, recaptured again in 2006 at site G and finally again in 2007 at site G. Another adult female was a recapture from 2004. Two adult males and one adult female were recaptures from 2005 and 2006. Additionally, one sub-adult male and one sub-adult female were recaptures from 2006.
- All captured animals were held for several minutes prior to their release to determine if they exhibited any symptoms of infection by *B. procyonis*. None of the captured animals exhibited any signs of infection by *B. procyonis*. All animals were ear-tagged with a unique identification number and released at the site of capture.
- A total of 32 man-hours of search effort were conducted at the trapping sites for raccoon scats and latrines. Twenty raccoon scats were located and collected during the search efforts. The scats were sent to the Fish & Wildlife Microbiology Laboratory at East Stroudsburg University in PA for analysis. Three of the twenty scats contained light *B. procyonis* egg loads.
- Due to the decline in capture index for the second consecutive year, piperazine-treated fishmeal/polymer baits were distributed at a rate of 10 – 15 baits per acre surrounding the active woodrat sites in an effort to interrupt egg shedding by infected raccoons. Additional treated baits were distributed along the shoreline of the Hudson River below the active woodrat sites as this serves as a travel corridor for raccoons. Treated baits were distributed at the site on December 20, 2007 and again on July 17, 2008.

Conclusions:

- For the second consecutive year the woodrat capture index has declined suggesting a possible decline in the Allegheny woodrat population within the Palisades Interstate Park. In addition, searches for raccoon scats/latrines suggested a possible increase in the raccoon population based on the amount of scats/latrines located, compared to previous years. Despite these findings, seven individuals were captured from previous years (2004 - 2006) suggesting that adult animals within the population are surviving for several years and not succumbing to *B. procyonis* infection. Additionally, none of the captured animals exhibited any symptoms of infection by *B. procyonis*.

Recommendations:

- Research (LoGuidice 2000, McGowan 1993) suggests that *B. procyonis* infection in Allegheny woodrat populations is a serious mortality factor and can result in rapid population declines for the

intermediate host. Therefore, woodrat/raccoon population monitoring at the Palisades Interstate Park site should continue. Periodic searches for raccoon evidence should continue and should include scat analysis for *B. procyonis* egg prevalence.

- Given that raccoon sign (scat and latrine sites) has increased in the area occupied by woodrats, it is recommended that fishmeal/polymer baits, treated with the anthelmintic drug piperazine, be distributed at regularly scheduled time intervals throughout the year in an effort to interrupt the egg-shedding cycle. Piperazine was chosen due to its high efficacy in clearing roundworms and its low toxicity (LoGuidice 2000).

Job 2: Bat Conservation and Management

OBJECTIVE 1: To identify, characterize and monitor summer bat colonies roosting within man-made structures and to provide guidance for proper management of those sites, especially where the federal endangered Indiana bats roost or maternity colonies exist.

OBJECTIVE 2: To identify, characterize, and monitor important winter habitats of New Jersey's bat species, including the federal endangered Indiana bat; and to gather Indiana bat winter population counts to contribute to USFWS database.

Key findings:

- A subsidence opened up adjacent to the Mt. Hope West mineshaft and threatened to have a negative impact on the suitability of the mine for hibernating bats. With assistance from the USFWS NJ Field Office, the subsidence was stabilized using equipment and materials from the Tilcon Corp. located adjacent to the Mt. Hope West Mine.
 - The area around the Mt. Hope West mineshaft was stabilized using fill material, a large diameter galvanized steel culvert and a concrete pad. In early May a bat friendly gate was installed on the concrete pad over the mine opening protecting it from potential human disturbance.
 - A cooperative agreement was signed between the landowner and the NJ Division of Fish and Wildlife (NJDFW) authorizing the NJDFW to post the property against trespass and to prosecute violators. The Division of Fish and Wildlife's Bureau of Law Enforcement now routinely patrols the site to protect it against trespass and vandalism.
- The bat gate at Hibernia Mine was vandalized and breached during late December 2007. The gate was immediately repaired by welding the cross members back in place and reinforcing them with additional steel. A security system is currently being installed that will notify state and local police in the event of a breach attempt. Proposals are currently being accepted to replace the gate. Improved design and materials will help deter future attempts at breaching the gate.
- ENSP biologists continued to provide technical assistance to state and municipal agencies and private individuals and land managers regarding the proper eviction and bat proofing of bat-occupied dwellings. In addition, technical assistance was provided for persons wishing to provide alternative roost sites where large colonies were evicted.
- A winter survey of the Hibernia Mine was conducted on 6 February 2008 in response to the spread of white nose syndrome (WNS) throughout the northeast. State and Federal biologists entered the mine in an effort to determine whether any bats exhibited symptoms of WNS. No evidence of WNS was found in any of the bats. Several bats were removed from the ceiling to observe their reaction to disturbance as lethargy and failure to arouse from torpor is a symptom of WNS. All bats appeared and responded normally. Although a total count was not conducted, there did not appear to be a detectable decline in the number of hibernating bats in the mine. A full count is planned for the winter of 2008-09.

- A survey of Leigh Cave was conducted in February 2008. The number of bats declined from 377 in 2005, to less than 40 bats in 2008. However, no evidence of WNS was observed in any of the bats inspected.
- ENSP biologists continued to conduct field surveys of abandoned mines and caves in northern New Jersey to assess their suitability as wintering bat habitat. Most surveys have documented flooded shafts, open fissures, shallow workings with too much airflow or, in some cases, no remaining evidence of previous mine activity. Thirteen mines were located and assessed for suitability as bat hibernacula during the current segment. Of these, one mine appeared to have the potential to support wintering bat populations. Additional assessment will be conducted during the fall of 2008 to identify the amount of pre-hibernation activity/swarming at the site. If bats are present, an attempt will be made to enter the mine during the 2008-09 winter. To date, a total of 124 mines have been field checked for bat suitability.
- USFWS-NJ Field Office coordinated a spring emergence sampling effort that was conducted at the Hibernia and Mt. Hope mines on April 21 and 22, 2008, respectively. USFWS and NJDFW staff and volunteers processed a total of 252 bats of four species. Fourteen *Myotis sodalis* (10 females and 4 males) were captured at the Mt. Hope West site and were fitted with unique-coded metal bands on the wings. Other species captured included 196 *M. lucifugus*, 39 *M. septentrionalis* and three *Pipistrellus subflavus*. None of the bats exhibited any conclusive evidence of WNS.
- Additional spring emergence sampling was conducted at the Mt. Hope West mine on May 6, 2008. Eight *Myotis sodalis* were captured; other species captured included 121 *M. lucifugus* and three *Pipistrellus subflavus*.
- Due to a staff resignation, follow-up to the 2006 Summer Bat Count was disrupted and most of the data from volunteers was not reported. The Summer Bat Count project was reorganized during 2008 and more than 90 volunteers were contacted to participate in the Summer Bat Count. Efforts have been and continue to be made to secure the data from volunteers that participated in both the 2006 and 2008 Summer Bat Counts to submit their data reports. Less than 50% of the participants from the 2006 Summer Bat Count have submitted their data and only five participants have submitted their data for the 2008 count.
- No summer roost sites were sampled using harp traps or mist nets during 2008 because none of the known major roost sites were suitable for trapping. Two large summer bat colonies reported from the 2003 Summer Bat Count were selected for surveys to determine if the number of bats using the roost had declined from the numbers reported in 2003. Counts at both sites (Hackettstown church and Yellowframe Church in Frelinghuysen Twp.) revealed that the colony size had remained comparable to previous counts (2003).
- No new data loggers were installed because no significant new bat hibernacula were discovered.

Conclusions:

- Sampling efforts conducted at several sites to detect the presence of WNS in NJ's bat populations showed no conclusive evidence that WNS was present in NJ bat populations.
- Many volunteers that participated in the 2006 and 2008 Summer Bat Counts did not submit their data forms due to confusion regarding what data was missing after the resignation of the staff member coordinating the study and the difficulty of retrieving data from the volunteers. ENSP continues to make attempts to recover the data from the volunteers.

Recommendations:

- Continue field surveys of abandoned mines and caves in northern New Jersey to assess their suitability for wintering bat populations.
- Replace the bat conservation gate at Hibernia Mine, as previous breaches have rendered the gate ineffective at preventing unauthorized access to the mine, and continue to monitor the population for trends and to evaluate the effectiveness of the gate.

- Install a security alarm system on the Hibernia Mine gate to detect breach attempts and to provide law enforcement personnel with the opportunity to capture the vandals.
- Conduct a winter survey of the Hibernia Mine in 2008-09 in an effort to determine if lower tallies from the 2007 survey can be attributed to different personnel conducting the counts or an actual decline in bat numbers. A new system, using photographic equipment, will be used to count bats in the future to eliminate counter bias.
- Visit a minimum of six hibernacula during the winter of '08-09 in an attempt to identify the presence of WNS in NJ's winter bat population. In addition, the sampling will be conducted shortly after the onset of hibernation to gather baseline data on pre-hibernation condition of bats.
- Evaluate the success of the 2008 Summer Bat Count reorganization effort at the end of the 2008 active season to determine the feasibility of continuing this part of the project. If feasible, continue the volunteer Summer Bat Count project and expand participation in the project in an effort to locate large summer bat colonies for sampling.

JOB 3: Pinniped Research and Conservation

OBJECTIVE: Develop a pinniped conservation plan to identify and protect overwintering colonies or haul-out areas and other transient occurrences of harbor seals and other pinnipeds.

Key Findings:

- ENSP contracted Conserve Wildlife Foundation of NJ (CWF) staff to perform site visits at the three major pinniped haul out areas in the state (Monmouth and Ocean counties) to conduct population surveys and identify potential threats. CWF staff was assisted in the field by staff from Richard Stockton College (RSC), who provided transportation to one of the sites as well as supplemental data on habitat usage, survey numbers and potential threats. Targeted surveys were also conducted by staff of the National Park Service, who provided data regarding haul-out site use at Gateway National Recreation Area.
 - One hundred fifty-five individuals, the highest count on record, were observed in April 2008 at the Great Bay site. Approximately one dozen individuals were observed at Sandy Hook in January and February 2008 while no individuals were observed at the previously documented Barnegat Inlet sites.
- CWF staff created an advertisement for inclusion in the NJ Division of Fish & Wildlife's annual Marine Digest, requesting that mariners and/or fishermen report their incidental observations of marine mammals and sea turtles to ENSP using the recently created Marine Rare Species Sighting Form. This form was also posted on ENSP's website for ease of submittal.
- Submittal of ENSP's general Rare Species Sighting Report Forms by individuals apart from CWF or the Marine Mammal Stranding Center (MMSC) staff yielded only two new pinniped records for inclusion in the Biotics database.
- Scientific literature regarding home range, foraging range, and habitat preferences was reviewed to refine species occurrence areas (SOAs) and choose appropriate land use/ land cover types from the NJ DEP's 2002 Level III Land Use/ Land Cover classification system to be applied in future versions of the Landscape Project.
- ENSP and CWF staff met with NJ Division of Fish & Wildlife Marine Fisheries staff as well as GIS and Marine Science staff from Richard Stockton College (RSC) to discuss possible alternatives for incorporating marine species data into future versions of the Landscape Project.
- ENSP contracted with RSC to acquire baseline data on New Jersey's largest seal colony (Great Bay) from 1994 to present and to perform a threats assessment and habitat characterization of the colony. Baseline data are to be submitted in a format compatible with the ENSP's Biotics database. Data submitted will include specific locations of haul-out sites as well as detailed data associated with

individual haul-out sites. The threats assessment will assess the magnitude of adverse impacts of threats to pinnipeds at haul-out sites based on multi-year observation data, including but not limited to disturbance by motorized watercraft; disturbance by non-motorized watercraft; and disturbance by aircraft. Possible means of mitigating such threats are also to be developed by RSC staff. Using RSC data on locations where pinnipeds have been observed, RSC and CWF staff will characterize these habitats using as many environmental variables as possible, including land-use/land-cover types, bathymetry, wave exposure, prey availability, anthropogenic disturbance, distance and access to open water and/or deep channels, etc. Based upon this characterization, GIS tools will be utilized in order to determine whether any other coastal areas within NJ also meet the criteria for pinniped habitat in order to direct future survey efforts.

- At the request of the DEP's Division of Science, Research and Technology (DSRT), ENSP biologists served as members of the NJ Wind Power Initiative Technical Review Committee. As part of the committee, we have input/oversight on the 2008-09 effort to survey for marine mammals (including pinnipeds), sea turtles, and birds by boat and aircraft in potential wind farm areas. Shipboard marine mammal surveys began in January 2008 and aerial marine mammal surveys began in February 2008. On June 30, 2008, Geo-Marine, Inc. (the Texas-based consulting firm which is conducting the survey) issued its revised first Quarterly Report, detailing activities and findings between January-March 2008. Thus far, shipboard surveys have counted three harbor seals in March 2008 while aerial surveys counted three harbor seals in February 2008. No GIS data has yet been submitted to ENSP. Upon the conclusion of survey work, all pinniped sightings gleaned from the survey will be incorporated into the ENSP's Biotics database. In May 2008, a fatal accident involving Geo-Marine's survey aircraft resulted in the indefinite suspension of aerial survey activity.

Conclusions:

- Repeated site visits by CWF staff resulted in survey count data for only one out of three sites visited.
- The Great Bay site continues to be the largest NJ haul-out site, in fact, the largest seal haul-out on the US Atlantic coast south of eastern Long Island, NY. Harbor seals continue to be, by far, the most numerous of the seal species present.
- The MMSC submitted data to ENSP regarding an as-yet unknown haul-out location within the Raritan River estuary, occupied by approximately 20 adults and sub-adults.
- The Marine Digest was released too late in 2008 to result in reported sightings for winter 2007-2008 seals, however it is hoped that it will result in data for the winter 2008-2009 period.
- Boat surveys focusing on known haul out locations may be more effective in terms of counting individuals and determining species.

Recommendations:

- Partner with the Marine Mammal Stranding Center (MMSC) and Richard Stockton College (RSC) to establish a secure web based video camera directed at the Great Bay, NJ seal colony. The camera should be positioned on Division owned property and used to supplement ongoing observations by RSC and MMSC seal researchers.
- Incorporate pinniped sightings information from 2008-2009 GMI, Inc. surveys into Biotics; identify threats to colonies/haul-out sites at new locations. If feasible, partner with GMI, Inc. to perform aerial surveys outside and north of the wind power project area.
- Apply SOAs and LU/LC types to seal occurrences (gray, harbor and harp) for use in future versions of the Landscape Project as well as additional ENSP GIS products.
- Continue to solicit pinniped sightings information from whale watch groups, fishermen, and environmental organizations.
- Incorporate RSC baseline survey data for the Great Bay seal colony into Biotics. Continue habitat characterization with RSC staff and identify coastal areas meeting pinniped habitat criteria developed

through the 2008 contract. Include information from RSC threats assessment and mitigation strategies into the coastal section of the Wildlife Action Plan.

- Revisit Barnegat Light haul out sites by boat to determine numbers, species present, and areas utilized. Boat surveys may be more effective at this location due to range of habitats and familiarity of individuals with boat traffic.
- Conduct outreach programs that focus on protecting pinnipeds from human disturbance and develop a NJ pinniped conservation plan.

EXECUTIVE SUMMARY

Project: Reptile and Amphibian Conservation
Federal Aid Project: T-1-4 (State Wildlife Grants)
Segment dates: September 1, 2007 to August 31, 2008
Total Project Expenditures: \$177,500 (\$133,125 Federal, \$44,375 State)

JOB 1: Federal and State Listed Reptiles and Amphibians

OBJECTIVE: To develop comprehensive, landscape-level conservation and management plans for all federal and state-listed reptiles to ensure long-term viability of populations.

JOB 1A: Bog Turtle

This job is jointly supported by State Wildlife Grants and Section Six funding.

OBJECTIVE: To monitor and conserve populations of the federally threatened and state endangered bog turtle (*Glyptemys muhlenbergii*) on public and private lands.

Key Findings:

- ENSP biologists and volunteers visited 28 bog turtle wetlands/occurrences this field season.
 - Six of the wetlands were identified by Phase I methods of having suitable habitat and were investigated for turtle presence using Phase II methods.
 - Bog turtles were discovered and/or mapped at 4 new wetlands this year:
 - Wetland 1: An ENSP biologist observed a bog turtle through binoculars moving through habitat while performing a bird survey. The turtle could not be relocated by the time the habitat was reached by foot. Subsequent visual surveys identified supplemental habitat but no additional turtles were captured. Wetland 1 represents an entirely new metapopulation.
 - Wetland 2: The second new discovery was in a wetland complex bisected by a major roadway. A shell and one live individual had previously been documented on the west side of the road during a Phase II survey, but no previous captures were known for the east side, other than from anecdotal reports. It should be noted that the east side wetland is on NJ state land.
 - Wetland 3: A citizen reported a bog turtle on his property and provided photo documentation. The turtle was found crawling down a mountain following a stream corridor. The source wetland from which this turtle presumably departed has not been identified. Known bog turtle wetlands exist downhill in the direction the turtle was traveling with one heavily used roadway lying between the turtle and the wetland.
 - Wetland 4: A 2006 bog turtle sighting was confirmed by identifying suitable habitat at the point of observation. No additional turtles were discovered in the wetland, but quality habitat exists. This wetland represents a new metapopulation.
 - Two wetlands with bog turtle habitat were investigated for turtle presence. One wetland surveyed this season was identified after a bog turtle was found crossing a road in the summer of 2007 in a county where bog turtles were presumed extirpated. A late 2007 field visit identified suitable habitat, but minimal survey effort was put forth due to time of year. Two volunteer consultants using Phase II survey techniques this season did not identify additional bog turtles. A second wetland complex was identified by a local resident to

- anecdotally support bog turtles; visual evaluation of the habitat from the road supported these claims. The landowner, however, denied access to survey the property.
- Twenty-two wetlands with extant bog turtle occurrences were visited.
 - Eight of the wetlands were visited to assess habitat management applied over the last 2 years. Management across all 8 sites was localized, targeted treatment of woody vegetation or Phragmites. In each case, the treatments succeeded in restoring habitat that was becoming unsuitable for nesting. Four of the wetlands have low density populations and short visual surveys did not produce new individuals or recaptures. The remaining 4 sites have higher density populations and turtles were found in the areas where restoration occurred.
 - The other 14 wetlands were visited to assess site threats and/or to update records of occurrence. Five of the wetlands are targeted for management after a Phase II is performed. The other 8 wetlands all produced turtles and biologists identified small areas where targeted restoration would likely produce an overall benefit in maintaining site suitability.
 - Dr. Ed Green from Rutgers University was contracted to assist in developing a population estimate mark-recapture study this winter and two subsequent meetings have led to the initiation of a study design. It is expected that the study should be implemented in the spring of 2009.
 - No future samples will be collected as the DNA project has ended.
 - ENSP coordinated with state and federal law enforcement on one ongoing investigation in Burlington County.
 - ENSP coordinated with 3 trustworthy Citizen Scientists and 10 consultants on the NJ qualified surveyors list to assist in presence/absence surveys and monitoring at 18 sites across the state.

Conclusions:

- While many bog turtle populations have been identified in the state, a large number of wetlands exhibit enough suitable habitats that may support new populations. As a long-lived species capable of persisting at low densities, multiple survey efforts are needed to determine true absence in a wetland with otherwise suitable habitat. The bog turtle is capable of traveling through terrain typically not identified as quality corridor in order to escape depleting wetland conditions or simply to colonize new areas that may cross watershed boundaries. While new sites are being discovered a larger number of extant sites are becoming historic due to changes in habitat and lack of corridors to new habitat.
- Habitat management continues to be an effective tool in controlling the rate of wetland succession and turtle observations in treated areas are now a regular occurrence when adjacent to currently occupied areas.
- The majority of occupied bog turtle habitat demands restoration both for vegetation and hydrology in order to continue to support viable populations.
- Cooperation with private landowners is crucial to the success of NJ bog turtle populations. The strongest documented populations exist on private lands.

Recommendations:

- Initiate survey efforts of extant habitats that have not been visited in at least 5 years to determine current population status. With limited resources one concept would be to target populations for research, restoration, and acquisition only where populations are deemed viable. Efforts should be made to reach out to the wildlife conservation community and volunteers to become “site stewards” to address the needs of low density populations. One technique may be controlled incubation and hatching of eggs as nest predation and unsuccessful hatching due to environmental factors may be the primary causes for population decline at some sites. This “headstart” method is being considered for two populations on federal properties.

- Restore potential habitat for vegetation and hydrology in an effort to make suitable habitat for colonization only in areas with connectivity to extant populations. Monitor success of restoration efforts for both effects on habitat and by performing periodic surveys for turtles.
- Continue to monitor known populations for population trend development and analysis of current habitat management strategies. Initiate mark-recapture population estimate study at these extant sites.
- Survey suitable habitats for currently unknown populations and continue surveys to determine population numbers at newly discovered sites from the last several years.
- Continue to rely on state and federal law enforcement agents to investigate poaching in NJ through regular site patrols and drive-bys and in prosecuting offenders.

JOB 1B: Wood Turtles

OBJECTIVE: To determine wood turtle (*Glyptemys insculpta*) productivity, recruitment and mortality factors for adults, juveniles and nests, as well as home range sizes and habitat selection. Use this information to develop conservation strategies for viable populations.

Key Findings:

- Sufficient data were collected in 2006-2007 via radio telemetry to inform Landscape models for the Highlands Region of the state, therefore no formal radio telemetry was conducted in 2008. Two wood turtles were radio-tracked at two different streams within and outside of the Highlands region for alternative motives:
 - Male – A male wood turtle was discovered by a citizen in a stream in late summer, 2007, in a highly developed part of the state. The stream from which it originated was known to support the species as recently as the mid-1990s. When an ENSP biologist met with the citizen who found and held the turtle they discovered the turtle had a drill hole in a rear marginal scute indicative of the turtle's previous anthropogenic manipulations, most likely thread-trailing. We attached a transmitter and released the turtle where it was found the following day and continued to periodically relocate the individual over the winter and throughout 2008. The goal of the exercise was to determine habitat use in a highly developed landscape, including impaired water quality, investigate species health in this environment, and to monitor activity which may lead to the discovery of supplemental, updated occurrences. The turtle maintained or gained weight over the course of the study and appeared healthy upon relocations when handled. No new turtles were found and the transmitter was removed in the late summer of 2008 before the battery expired.
 - Female – An adult female wood turtle from a 2006 study site was relocated and a transmitter was attached to her just after emergence to investigate the individual's nesting preference. The study site is on a Natural Lands Trust property where the wood turtle population may be no more than 5 individuals; all adults. Experimental nest pits were installed in late June of 2008 after wood turtles had already nested so the female did not have the opportunity to find them this year. The transmitter was removed in the summer after she had nested in her regular area.
- Unused resources dedicated to radio telemetry were used to initiate an experimental wood turtle nest pit study design in cooperation with landowners enrolled in the Landowner Incentive Program and through cooperation with NJ Audubon Society. Nest pits were installed post-wood turtle nesting season in 9 locations adjacent to streams with extant wood turtle populations. Motion sensitive cameras were installed at each pit to calibrate them for the following season (2009) and to monitor for depredation of nests that may have been deposited after creation (box turtles, stinkpots, snapping turtles). No turtles were captured on film, but a variety of potential turtle nest predators (raccoon and red fox) were found investigating the pits.
- Data within the Biotics database shows a large distribution for the wood turtle across much of the northern part of the state. However, few turtles are located during surveys, leading ENSP biologists to

believe that while occurrences for the species are high, population viability is low. Resources were geared towards involving volunteers in conducting surveys of unknown and low density sites with the goal of updating occurrence records and identifying populations in need of management, which may include the use of nest pits. Volunteer efforts should begin next season.

- ENSP biologists have coordinated with volunteers to identify a population in the Inner Coastal Plain physiographic region, which is considered the periphery of suitable habitat in the state. Known from a shell and live individual, volunteers and staff will survey the site beginning this fall to determine population presence, which may represent the most southern viable population in the state.
- ENSP met with the NJ Division of Fish and Wildlife's Bureau of Law Enforcement (BLE) in 2006 to address collection concerns of wood turtles. Incidents are reported to Law as they occur. No reports of illegal collection of wood turtles were made this year by ENSP to BLE.
- ENSP will coordinate with the NJ Division of Fish and Wildlife's Bureau of Lands Management (BLM) staff to manage for wood turtles on state lands after populations are assessed using visual encounter surveys. BLM staff did work to restore known wood turtle nesting habitat at one state property prior to nesting this season.
- Volunteers monitored nest pit cameras and assisted in surveys at 5 sites this spring. Fall surveys are scheduled to begin at the end of October.

Conclusions:

- While the number of occurrences appears to be high only a small number of populations supporting more than 10 individual turtles are known relative to the number of streams wood turtle occur in. Based on the apparent mature age of the male wood turtle tracked this year, the species can persist in suboptimal conditions, both in terms of terrestrial and aquatic habitat. Reproductive success appears to significantly decline, though, based on the lack of variant age-classes observed at these compromised sites. Subsidized predators disturbing nests, poaching, and road mortality may be the primary causes of population decline at urban and suburban sites.
- Predator exclusion fencing may be a necessary accessory to implementing wood turtle nest pit installation based upon evidence gathered from motion sensing cameras this past year, especially during the first year when local predators may be attracted to the altered habitat.
- Coordination with the BLE and federal law enforcement for bog and wood turtles took place in the 2005-2006 reporting period and was unnecessary to meet again this reporting period. Officers received all pertinent information at the previous meeting.

Recommendations:

- Begin study design and production of predator exclusion fencing for wood turtle nest pits at the study sites.
- Continue training and coordinating volunteer involvement to complete wood turtle surveys at low and unknown density sites on both private and public properties.

JOB 1C: Timber Rattlesnakes

OBJECTIVE: To conserve NJ's timber rattlesnake (*Crotalus horridus horridus*) populations through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review.

Key Findings:

PINELANDS REGION

- ENSP biologists received 5 timber rattlesnake calls over the past field season and acted on one of these calls by picking up a snake that was hit by a car near Chatsworth, NJ. This snake was taken to

the Cape May County Zoo where it was rehabilitated by the veterinarian on staff. Once rehabilitated, this snake was released at the point of capture (away from the road) on September 9, 2008.

HIGHLANDS REGION & KITTATINNY RIDGE

- ENSP volunteers and staff surveyed for rattlesnake presence at potential dens during the emergence period.
 - Using the den model ENSP developed in the spring of 2005:
 - Approximately 17.92 kilometers of ridgeline (with belts widely ranging in width dependent on geomorphic structures) were surveyed, extending to the NY border. Coordination of volunteers' and staff's work schedules was difficult this year, with only four volunteers assisting during den emergence; one surveying on two days, one surveying on three days, and two surveying one day each. Often one ENSP biologist surveyed alone during optimal weather conditions.
 - Two known dens (one ridge-based den and one interior forest den) were visited during emergence, once each, with observations of timber rattlesnakes and northern copperheads at the ridge-based den. One black racer was observed basking approximately 40 meters from the same den crevice.
 - Staff and volunteers surveyed one additional ridge (approximately 0.73 km of ridgeline), not valued by the den model, and discovered a previously unreported den area. Precise den location should be confirmed this fall with the ingress of a transmitted rattlesnake.
- During the 2008 field season, three snakes (snakes 0801, 0802, and 0803) were captured in targeted areas and implanted with radio-transmitters, with transmitters weighing 1%, 1% and 0.7%, respectively, of each snake's body weight. The three snakes (including one from the den area discovered during spring den searches) are believed to be from previously unreported dens based on their proximity to known dens at the time of capture. Den locations will be confirmed during fall ingress. The remaining two snakes were captured by the Venomous Snake Response Team and released to the ENSP for study.
 - Staff has tracked the three snakes between once and twice per week throughout the foraging season. As the period of ingress approaches, it may be necessary to increase the tracking frequency.
 - In an effort to ensure rapid release, Kathy Michell, rattlesnake researcher and rehabilitator and ENSP volunteer, surgically implanted the transmitters. Snake 0801 was captured and released on May 14 and 17, respectively. Snake 0802 was temporarily held for observation prior to surgery after being "stoned" by a landowner to ensure her well-being, she was captured and released on July 9 and July 18, respectively. Snake 0803 was captured and released on July 29 and August 5, respectively. He, too, was held temporarily for observation after being harassed and possibly injured by landowners.
 - All snakes were determined to be in good health. Snake 0802 showed signs of injuries along her spine (possibly from the stoning), but it did not appear to impact her behavior or activity.
- Staff met to determine the potential macro-habitat GIS data layers required for analysis at a landscape scale and has obtained the following data layers:
 - 2002 Stream Network; NJDEP, OIRM, Bureau of Geographic Information and Analysis
 - Soils (SSURGO); NJDEP/NRCS
 - 2002 Land Use Land Cover; NJDEP, OIRM, Bureau of Geographic Information and Analysis
 - 10m Digital Elevation Grid; NJDEP, OIRM, Bureau of Geographic Information and Analysis
- We summarized these reports of killings and harassment from work conducted under non-federal funding):
 - One male rattlesnake was purposely killed in a State Forest; the violators were charged and fined under the NJ Endangered and Nongame Species Conservation Act.

- One female rattlesnake, brought to rattlesnake rehabilitator, Kathy Michell, had been fatally wounded in a landowner's attempt to kill her; the landowner was not charged.
- One man discovered harassing a gravid female at her gestation site was charged and fined under the NJ Endangered and Nongame Species Conservation Act.
- No strategy has been developed to recruit law enforcement to monitor den locations for illegal collection. Due to limited staff, the BLE continued to be unable to monitor the areas ENSP biologists identified as potential collection sites. ENSP staff continued to consider the potential positive and negative effects of releasing den location data to those outside the Department of Environmental Protection.
- Thirty-eight volunteers were trained/ retrained in 2008 as members of the Endangered and Nongame Species Program's Venomous Snake Response Team within the northern region. There were 23 new volunteers and 15 returning volunteers.
- Venomous Snake Response Team reported responding to seventeen complaints on private lands during the 2008 field season, eight were confirmed to be timber rattlesnakes in addition to one northern copperhead. Three of the reported incidents occurred in the Ringwood area (two confirmed rattlesnakes, one snake missing upon arrival), nine in West Milford (three confirmed rattlesnakes, one copperhead), and two confirmed rattlesnakes in Jefferson Township.
 - Of the 82 active members of the northern Venomous Snake Response Team, fifty-five submitted official timesheets reporting their 2008 response time; fourteen volunteers' time was extracted from response team training sign-in sheets.
- ENSP staff completed data entry of the 312 random habitat points (Highlands study) surveyed in 2005-2006; two points were not entered because they occurred in New York state and thus we were unable to value the habitat through Landscape Project and GIS. The sites had been selected with a 95% CI, using ESRI's ArcView 3.2 © software's Animal Movement Extension; fulfilling a random set of habitat points at 10% AE. The random habitat points were surveyed to compare the habitat available versus the habitat the snakes used during the 1999 Kittatinny study and the 2003-2005 Highlands study. One hundred random habitat points were surveyed in 1999-2000 along the Kittatinny Ridge during the Kittatinny study. All habitat points (random and those where snakes were observed) were assigned land use classes according to the NJ DEP, 2002 Level III Land Use/ Land Cover (LULC02) data.
 - Kruskal-Wallis analyses of available habitat on the Kittatinny Ridge (n=100) and within the Highlands Region (n=312) showed no significant difference between habitat selection and habitat availability; $\chi^2=3.388$, P=0.065
 - Highlands Study
 - There was a significant difference between habitat use (n=476) and habitat availability (n=312) for rattlesnake foraging and den locations (Kruskal-Wallis, $\chi^2=8.691$, P=0.003).
 - There was a significant difference between habitat use (n=476) and availability (n=312) for rattlesnake foraging locations (excluding den locations) (Kruskal-Wallis, $\chi^2=6.914$, P=0.008).
 - Rattlesnakes avoided 17 types of habitats that were available and used five habitats in greater proportion than their availability. Deciduous forest with >50% crown closure contained 76% of the snake locations but only 57% of the random habitat locations. An addition four habitat types, including athletic fields (schools), coniferous forest (10-50% crown closure), deciduous brush/shrubland, herbaceous wetlands contained 3.62% (excluding den habitat) and 3.36% (including den habitat) of the snake locations but no random habitat points; indicating these habitat types are rare.
 - Kittatinny Study
 - Kruskal-Wallis analyses of timber rattlesnake habitat use, including both den and foraging habitats, compared with the type of available habitat showed no significant difference between habitat selection (n=307) and habitat availability (n=100); $\chi^2=0.583$, P=.444.

- Kruskal-Wallis analyses of timber rattlesnake habitat use, excluding den habitats, compared with available habitat showed no significant difference between habitat selection (n=307) and habitat availability (n=100); $\chi^2=1.091$, P=0.296
- Even though habitat analysis did not detect a significant difference between random points (available habitat) and snake locations (snake-used habitat), the random locations included seven habitat types where rattlesnakes had not been observed. In addition, eight habitats were used by snakes but were not found in the computer-generated random habitat locations.
- Two rattlesnakes implanted with transmitters within the Highlands Region in 2007 for continued monitoring in 2008 (one male that used NY during the summer season and one female believed to be gravid in 2008) could not be relocated due to transmitter failure.

Conclusions:

PINELANDS REGION

- Dirt and paved roads in the Pinelands fragment critical timber rattlesnake habitats and pose a major threat to this species.

HIGHLANDS REGION & KITTATINNY RIDGE

- The ENSP's northern region's Venomous Snake Response Team continued to be effective at rapidly responding to rattlesnake reports made by the general public and providing additional distribution locations for the ENSP's Biotics database.
- Additional surveys are still needed to validate and refine the den model.
- Unknown den locations and gestation and basking areas persist throughout the Highlands region.
- Basking areas and foraging grounds exist on both public and private lands within the Highlands region. The ratio of potential basking habitat on private versus public lands has not been determined. However, due to the inefficiency of GIS to identify all potential basking habitat, this may be an impossible task at this time.
- Increasing development and roads continue to impede travel between habitats, isolate populations, and limit habitat use.
- Obtaining completed timesheets from volunteers continues to be difficult.
- The difference in habitat use versus habitat availability within the Highlands Region was somewhat unexpected given the results of the Kittatinny Ridge analysis and the appearance (to the researcher) that Highlands forests are somewhat homogeneous. The snakes were clearly selecting preferred habitats for summer use. Further analysis must be conducted to determine the effects of including/excluding den habitats when evaluating habitat selection.

Recommendations:

PINELANDS REGION

- Continue to maintain the Pinelands Venomous Snake Response Team.
- Conduct research to assess effects of roads on timber rattlesnakes in the Pinelands. Identify stretches of roads where high mortality of this species occurs and develop a strategy for reducing snake mortality in these areas.

HIGHLANDS REGION & KITTATINNY RIDGE

- Continue radio-telemetric research to identify additional critical habitats in areas where data gaps exist. Focus on areas that potentially will identify 1) links connecting populations throughout the northern edge of the Highlands region, 2) populations at risk of human encroachment and increased human-rattlesnake interaction, and 3) populations using intrastate habitat (NY-NJ) for their summer ranges.

- Further analysis of used versus available habitat within the Highlands Region must be completed to better understand the snakes' needs to develop a critical habitat model for integration into NJ's Landscape Project map.
- Analysis of macrohabitat features (including GIS data gathered this season) must be completed to better understand the snakes' needs to develop a critical habitat model for integration into NJ's Landscape Project map.
- Continue to recruit and train volunteers for the Venomous Snake Response Team in an effort to capture rattlesnakes from currently unknown populations or from areas where populations are known to exist, but critical habitats are undetermined, and to safely remove snakes from human-inhabited areas for the safety of the snakes and NJ citizens.
 - Consider coordinating team leaders for areas responsible for the collection of completed timesheets mid-September and mid-November of each year.
- Recruit dedicated volunteers to conduct den model validation searches. Isolate volunteers to thoroughly survey smaller, more localized areas regularly rather than surveying larger areas sporadically.
- Continue to develop methods to recruit NJ citizens to report rattlesnake observations to help populate the ENSP's Biotics database.

JOB 1D: Northern Pine Snake

OBJECTIVE: To conserve populations of state-threatened Northern pine snakes (*Pituophis melanoleucus melanoleucus*) by identifying critical habitats, monitoring trends in populations, productivity and habitat, evaluating meta-population and genetic diversity issues, and implementing innovative habitat management practices.

Key Findings:

- Beginning in October 2006 the Endangered and Nongame Species Program initiated a long-term (7-year) study on the movements and habitat use of Northern Pine Snakes on, and around, the Stafford Forge Wildlife Management Area (state-owned land). During the past field season a total of 24 Pine Snakes were radio-tracked as part of this study. Additionally, this year we also carried out data analysis on the 2007 field season. Details of these activities are summarized below and in the future these data will be used to refine our existing pine snake models and will contribute to the development of predictive modeling for this species.
 - **Data Collection During the 2008 Field Season:** As part of the radio-tracking study we determined the location of each study snake every other day throughout the 2008 field season. Habitat characteristics such as percent cover, soil type, distance to nearest tree, and vegetative community composition were recorded each time a snake was relocated. However, data analysis has not yet been carried out on the 2008 field data.
 - **Data Analysis Conducted During 2008:** During this reporting period data analysis was carried out on the radio-tracking data originally collected during the 2007 field season.
 - *Mortality Rate:* Of the snakes radio-tracked during this time our study snakes experienced a 43% mortality rate. Snakes died from the following causes: hawk mortality (17.5% or 7 snakes), miscellaneous causes (10% or 4 snakes), wildfire (7.5% or 3 snakes), overwintering (5% or 2 snakes), and transmitter complications (2.5% or 1 snakes).
 - *Activity Range:* The mean activity range (using Minimum Convex Polygon) calculated for snakes with >30 telemetry relocations (n=15) was 313 acres or 126 hectares.
 - *Behavioral Observations:* When the study snakes were relocated as part of the telemetry study the snakes were most often "found" either underground or concealed under vegetation or structure (see "All Snakes" in figure A below).

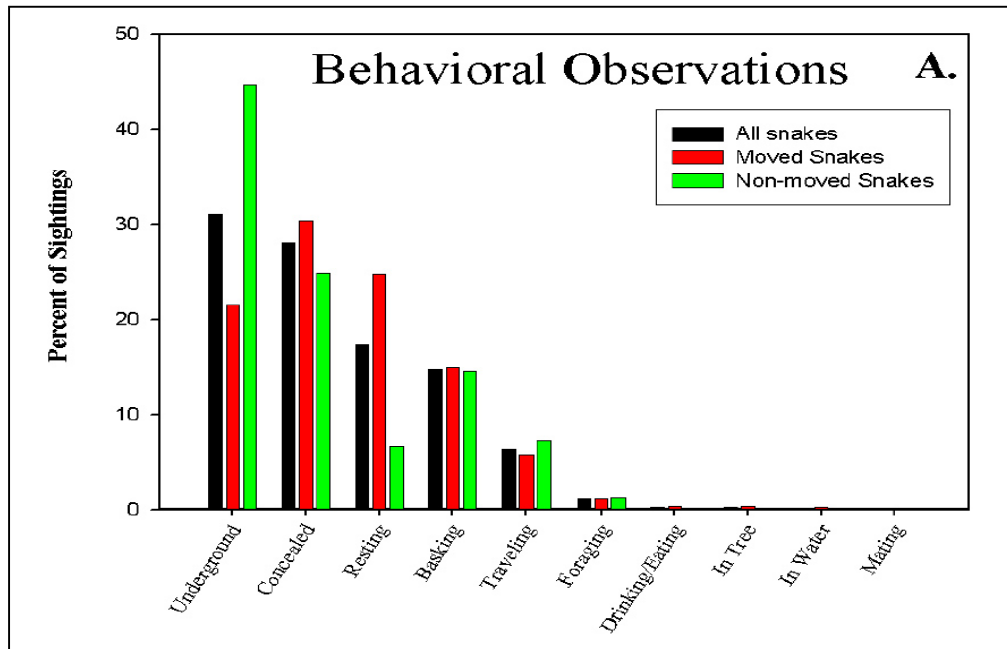
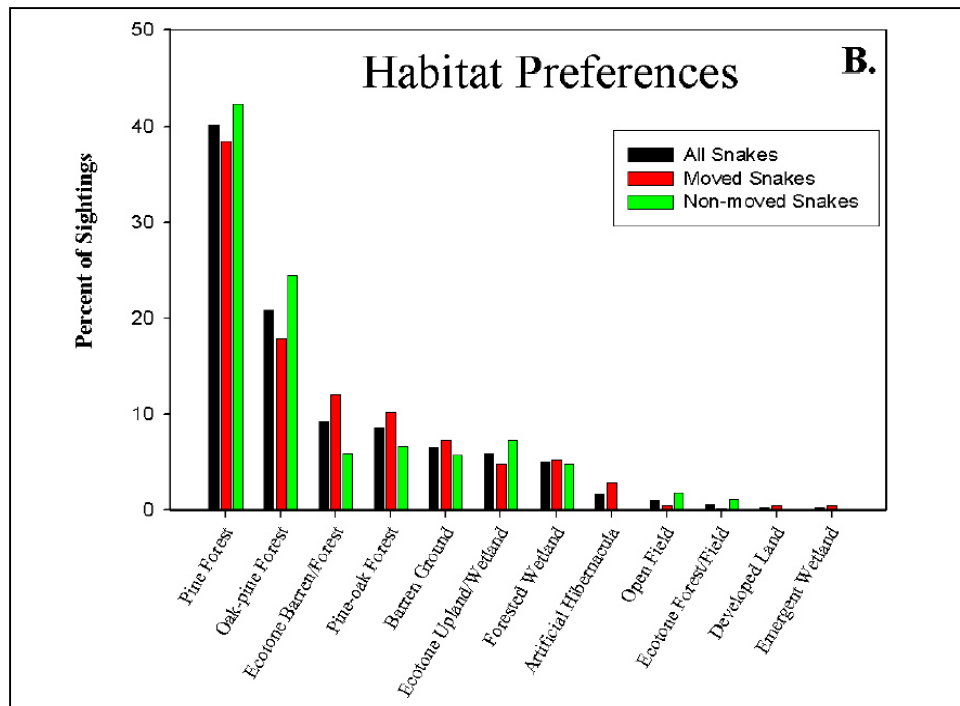


Figure A. Behavioral observations of snakes during the 2007 field season.

Habitat Preferences: Over 60% of the pine snake telemetry relocations were made within pine forest or oak-pine forest (see “All Snakes” in Figure B below).



- Between October 2007, and September 2008, 35 new pine snake records were reviewed by ENSP biologists and an additional 10 new records were entered into ENSP's rare species tracking database (Biotics).
- Targeted pine snake surveys on state lands were not carried out during 2008. However, the pine snake radio-tracking study described above was carried out almost entirely on state-owned land.
- ENSP biologists reviewed over 18 development applications within the NJ "CAFRA Zone" and evaluated the proposed activities for possible impacts to northern pine snakes. These applications included proposals for new road construction, housing subdivisions, and retail stores. One application for a bypass road led ENSP to recommend that "snake underpasses" be constructed under the proposed road. Using wildlife underpasses to create or maintain habitat connectivity is an approach that ENSP has recently begun to promote for new road construction and road improvement activities

Conclusions:

- A long-term research project to examine the typical home range size and habitat use of the northern pine snake is currently underway. Preliminary home range and habitat preference results have been reported. Once this study is complete, a final analysis on these data will be a crucial component in the testing and updating of ENSP's existing pine snake models.
- The Biotics database continues to be updated with sighting records for northern pine snakes and this information will ultimately make its way into the Landscape Project mapping.
- ENSP has recognized that roads are a major contributor to T&E species mortality and serve to isolate breeding populations of small and slow-moving animals. New permit applications are now being reviewed with this in mind and recommendations on using wildlife underpasses are being included in application reviews where appropriate.

Recommendations:

- Continue to collect and summarize findings from the pine snake radio-tracking study and use the data to test existing pine snake habitat models.
- Continue to research and implement strategies that will reduce the impacts of roads on pine snake populations in the state.

1E: Northern Copperhead

OBJECTIVE: To determine the distribution of and conserve NJ's northern copperhead (*Agkistrodon contortrix mokeson*) populations through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review, and to identify northern copperhead dens and critical habitat use.

Key Findings:

- Northern copperhead location data was compiled (Fig. 1) and includes data compilation from 2007. Five locations were added during this segment:
 - ENSP compiled identified copperhead locations from ENSP's Biotics database (confirmed observations since February 2007 as of August 31, 2008), rejecting observations believed to be in inappropriate territory/geographic locations. The resultant map identified one additional location; shown as a solid light blue rectangle on the map, Figure 1.
 - Two additional sites/ areas (shown as solid purple rectangles on the map, Fig. 1) were discovered by ENSP biologists and reported for inclusion in the Biotics database including one den area.
 - ENSP attempted to contact individuals including hobbyists, professors of herpetology, and wildlife professionals for additional location data, but only one hobbyist was able to provide information on one location, accompanying biologists to the site; therefore the location is listed under "Observations

made by ENSP...2008, in Figure 1 below, and as such is shown as a solid purple rectangle). In addition, one volunteer/consultant acknowledged having location information but was unable to coordinate his schedule to meet with ENSP staff.

- Volunteers were not solicited to search potential den locations of historic observations as many fall on private lands, and the limited experienced “snake” volunteers were directed to focus on rattlesnake den searches.
- Members of the Venomous Snake Response team reported one confirmed observation of a copperhead.
- No public call for observations was made due 1) the public’s dislike for snakes, venomous or non-venomous, 2) the difficulty in validating the public’s observations as many citizens commonly misidentify eastern milk snakes and northern water snakes for copperheads.

Conclusions:

- Northern copperhead observations are still lacking:
 - There continues to be few reported (and confirmed) northern copperhead observations on private lands.
 - Alternate sources for observations are difficult to obtain whether due to our contacts being unaware of copperhead presence or that they do not wish to share location data.
 - Copperhead observations are limited which may be, in part, due to their highly cryptic nature, often more difficult for the public to observe than rattlesnakes.
 - No literature has been found regarding copperhead home range territory and distances traveled to and from dens nor on landscape (macro-habitat) scale needs; minimal literature exists on micro-habitat needs/ requirements.
 - The effort to simplify the reporting process by holding one-on-one meetings with the observer to provide a single map and list of locations, rather than multiple *Sighting Report Forms* (ENSP standardized reporting system), proved unsuccessful as the observer and staff were unable to coordinate schedules.

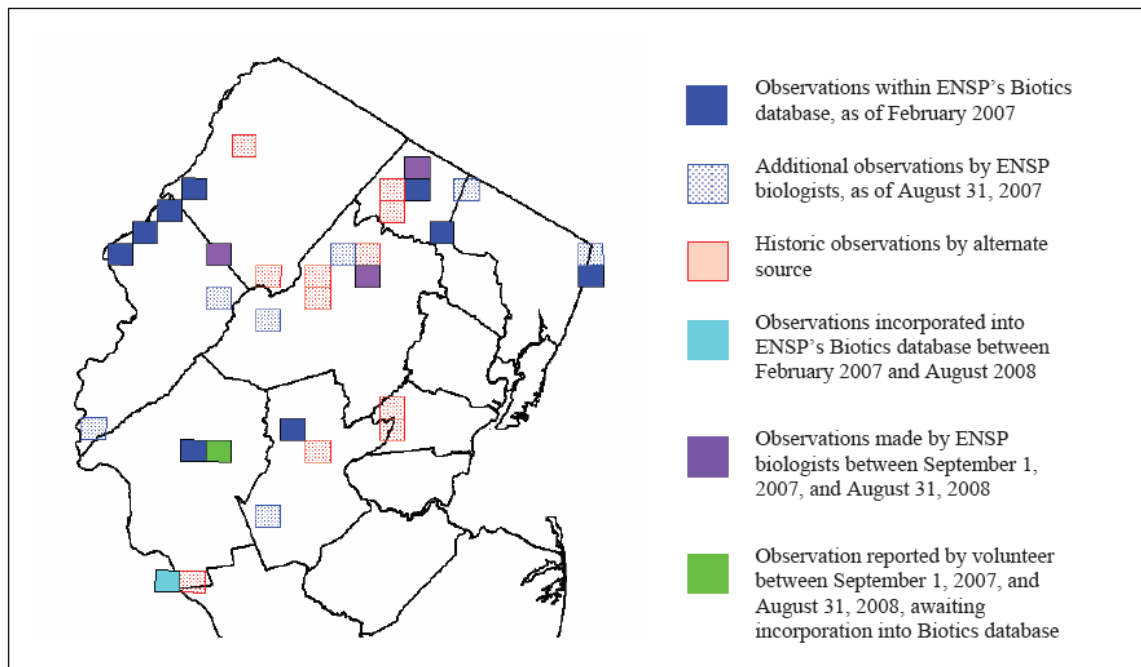


Figure 1: Distribution map of northern copperheads throughout the northern range of New Jersey as of August 31, 2008; includes one additional observation incorporated into ENSP's Biotic database during the previous segment year.

Recommendations:

- Continue to obtain northern copperhead location data.
 - Recruit assistance from conservation organizations.
 - Recruit assistance from the Division of Parks and Forestry.
 - Continue to work with the Venomous Snake Response Team.
- Reach out to landowners/ organizations that are land stewards where copperheads exist to recruit assistance in locating critical sites (dens, gestation areas, shed sites) and for potential research projects (e.g., habitat restoration, habitat study through telemetry).
- Conduct radio-telemetry study on copperheads to determine range and landscape-scale requirements so protective management strategies can be applied to currently known dens.

JOB 2: State-Listed Amphibians

OBJECTIVE: To develop comprehensive, landscape-level conservation and management plans for all state-listed amphibians to ensure long-term viability of populations. These plans will contain concise delineations of critical breeding habitats, terrestrial habitats, and dispersal corridors, strategies and techniques for addressing threats, and long-term monitoring protocols for assessing population status over time.

JOB 2B: Long-Tailed Salamanders

OBJECTIVE: To identify viable populations of long-tailed salamanders (*Eurycea longicauda*), assess threats, and implement actions to protect the riparian and lacustrine habitats they inhabit.

Key Findings:

- Over 80% of known locations for long-tailed salamanders were surveyed from 2006-2007 so no additional sites were visited during 2008. The remaining 20% of sites were on private property where landowner permission could not be obtained. The success of the earlier surveys was enough to guide study plan decisions into this reporting year.
- Data obtained from 2006-2007 surveys guided the modeling of a GIS-based predictive map:
 - Biologists selected several habitat variables for analysis (i.e., distance to limestone bedrock, streams, vernal pools, and percentage of land use/land cover types), and compared habitat characteristics of areas where long-tailed salamanders (long-tails) occurred to randomly selected areas to build a habitat selection model (Fig. 1) using statistical and GIS analyses.
 - The variables that best predicted the presence of long-tails were residential areas (negative relationship) and limestone areas, mixed forest with >50% crown closure, areas with streams/canals, and near vernal pools (positive relationship).
 - There is a strong association between longtail salamander occurrences and limestone bedrock. Limestone bedrock makes up only 16% (1270/7959 km²) of the Ridge and Valley, Highlands, and Piedmont physiographic provinces, yet 79% of longtail salamander occurrences were located in areas of limestone.

- The predictive model provides ENSP biologists with an insight into the amount and distribution of habitat and is tool for targeting areas to survey for new occurrences, though it has not been tested with an independent dataset to determine the degree of confidence with which it can be used.
- Volunteers monitored known sites to document additional occurrences at areas where single specimens were found during earlier surveys. This data is still being submitted to the ENSP and integrated into the Biotics Database which then informs the Landscape Project mapping. Two of the volunteer submissions have preliminarily been mapped in areas identified by the predictive map as being highly suitable for presence of long-tails.
- Lack of staff time did not allow ENSP to monitor population dynamics at reference sites or survey areas identified as having suitable habitat by the predictive map.

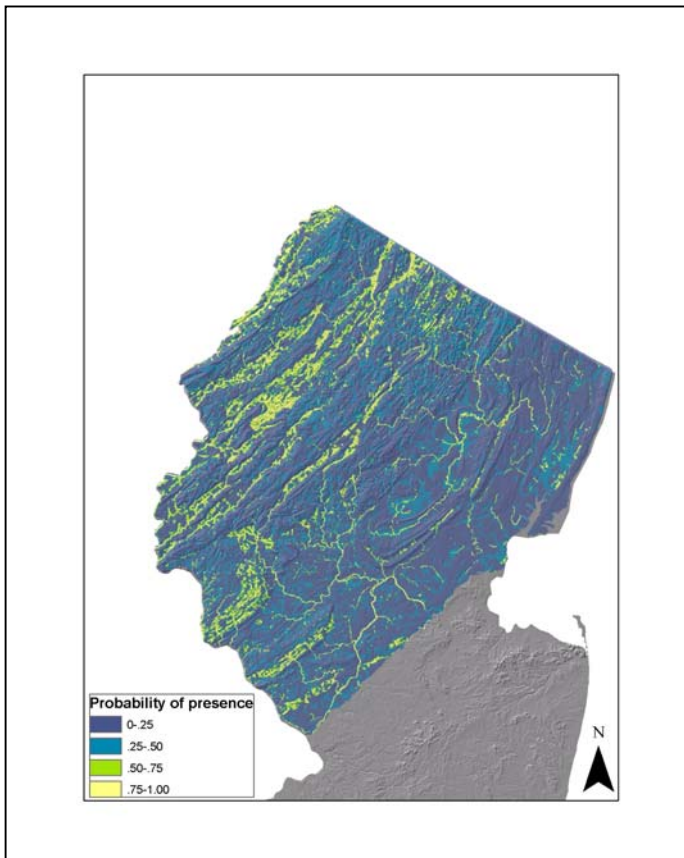


Figure 1. Predicted probability of long-tailed salamander presence in northern New Jersey. The lighter colors indicate higher probability.

Conclusions:

- Long-tailed salamander distribution is highly correlated to the presence of limestone in NJ and new populations should be present along these gradients.
- Volunteers will serve well in surveying areas identified by the predictive map, especially on public lands.

Recommendations:

- Use the predictive map to target surveys in the future. Results of these surveys can be used to inform revisions to the suitability/probability map.
- The long-tailed salamander is a relatively unknown state-threatened species and may be under-reported to ENSP through Sighting Report Forms. Articles in non-profit newsletters or an online ENSP article may better publicize this species as important to document.

2C: Amphibian Crossing

OBJECTIVE: To identify amphibian breeding migration corridors along county and rural roads in need of protection through raised roads, culverts, and/or temporary road closings.

Key Findings:

- October 2007, ENSP and the New Jersey Audubon Society (NJAS) met to develop “plan of action” to recruit towns to implement local road closures and assist in surveys.
- ENSP staff and partner, NJAS, met with three townships, Independence, Allamuchy, and Stillwater requesting road closures at high-density amphibian crossing sites and assistance to survey the sites.
 - Independence Township, Warren County:
 - ENSP and NJAS met with the Independence Township Environmental Commission to request a temporary road closure and possible survey assistance. The Commission discussed the matter with their town council and all agreed to close the road (a maximum of three times) and assist in the closure, but they were unable to provide survey assistance. (Please note that one environmental commission member has been an amphibian crossing volunteer for five years.)
 - Allamuchy Township, Warren County:
 - ENSP met with the Allamuchy Township Environmental Commission too late in the season to make the necessary arrangements, but the Commission expressed a strong interest in working together during the migration of 2009.
 - Stillwater Township, Sussex County:
 - ENSP and NJAS met with the Stillwater Township Environmental Commission and NJAS met with the town council to request a temporary road closure and survey assistance.
 - The road closure was accepted by the Commission but denied by the town council.
 - Environmental Commission members agreed to survey one local site, but due to scheduling and the spontaneity of the survey, they were unable to organize the survey team when needed.
- Volunteers manned two 100-meter length survey sites where amphibian crossings occur, both “rescue only” sites. Data collection was limited as the migration occurred over a period of several days during a 3-week span.
 - Independence Township, Warren County:
 - March 4, 2008; an early and unexpected migration, survey period - 1845–2245 hours– ROAD NOT CLOSED
 - Volunteers conducting random visits to the site (totaling approximately 4 hours) reported fifty-seven (57) amphibians crossing (live or dead on road).
 - March 7, 2008; 8:30 pm (site preparation), survey period 2110–2340 hours – ROAD NOT CLOSED
 - Volunteers conducting a structured 2.5-hour survey (i.e., following ENSP protocol), with no road closure, counted over 250 amphibians crossing (188 alive during the survey, approximately 30 before the survey began during site preparation, and approximately 50-70 dead on the road by the end of the survey).
 - Approximately 31 vehicles traveled through the corridor during the survey period, killing 22-31% of the amphibians crossing in spite of volunteers’ efforts to rescue amphibians from being run over.
 - Weather conditions consisted of a steady drizzle and temperatures decreasing from 5.2 - 4.5°C (41.36 - 40.1°F) over the course of the survey period.
 - March 14, 2008; 1830 hours (site preparation), survey period 1900–0500 hours – ROAD CLOSED

- Independence Township closed the road at 18:30, volunteers monitored the site from 1900-0500 hours.
- Volunteers counted 345 amphibians crossing the road. During the survey, 11 vehicles traveled through the corridor.
 - o The majority of the amphibians (229) crossed from 2130 hours – 0230 hours when temperatures ranged from 9.7 – 5.4°C (49.46 – 41.72°F) and rain was variable, neither the warmest, coolest, or wettest period of the night.
- Weather conditions varied, beginning the survey when it was dry and windy with a drizzle starting at approximately 2020 hours (as did amphibian movement). The remainder of the night varied between a steady and intermittent drizzle to a mist. Temperatures ranged from a high of 14.3 and a low of 4.5°C (57.74 °F and 40.1°F, respectively) with the warmest period occurring between 2100–2130 hours, but then continued to decrease over the course of the survey period.
- o Montville-Lincoln Park Townships, Morris County:
 - Survey site was eliminated due to a high volume of vehicular traffic and the suspected extirpation in the past five years of the amphibian population that once traveled across this road.
- o Montville Township, Morris County: March 14, 2008, approximately 2145–2345 hours
 - Survey was conducted on nearby intersecting, unpaved local road.
 - No amphibians were observed.
 - No vehicle traffic was recorded by observers.
 - Weather conditions consisted of a steady, light drizzle/mist; no temperatures were recorded.
- o “Survival” site in Hardwick Township, Warren County was not surveyed in 2008. Data collected in previous years was used to support the need for temporary road closures and volunteers were assigned to other areas in need of surveyors.
- Volunteers were assigned survey areas for potential crossings based on ENSP’s vernal pool coverage, aerial photographs, and topography. Survey of 52 potential crossings ranging from 0.07 - 3.8 km lengths at 0.5-hour intervals during potential emergence nights when weather conditions were appropriate resulted in amphibians being observed crossing at 35. One location demonstrated the potential to be a high-density amphibian crossing with 215 amphibians observed over four nights (0.5 hr survey periods each night), 147 of them in a single 0.5 hr period.
 - o As expected, drive-around surveys adjacent to Wallkill National Wildlife Refuge resulted in amphibian observations at eight out of eight survey areas; no significant crossings were observed during the survey periods.
- No model has been developed to identify other potential crossings as we have been unable to confirm significant crossings through the “drive-around” surveys and obtain the necessary information. Failure to confirm locations was a result of amphibians traveling over multiple nights during a 2–3 week period in lower densities, rather than moving *en masse*, making it difficult to determine the crossings’ importance to the local population.
- No grants have been sought yet for any permanent management strategy (e.g., culverts, raised roads) due to a lack of supportive evidence.
- Five organizations/ agencies, in addition to the Conserve Wildlife Foundation of NJ and the NJ Audubon Society, continued their partnership with the ENSP and assisted in surveys including the Schiff Nature Preserve and Land Trust, Mendham Twp. Environmental Commission, Morris County Park Commission, Montville Twp. Environmental Commission, and the Friends of Wallkill River National Wildlife Refuge (NWR) and the NWR staff.

Conclusions:

- Data collection has been complicated and limited (2003-2008) due to mass migrations occurring at “inconvenient” hours for volunteers to survey and over the course of multiple nights in lower densities.
- “Drive-around” surveys were a successful means of gathering general information about potential crossings and required minimal volunteer management.
- Lack of preparation early in the season may have caused the survey team to miss the most productive night to observe amphibians crossing in Independence Township on March 7, 2008. Given 250 amphibians were observed with a small volunteer crew in a short period of time, and weather conditions were optimal throughout the night.
- Road closure efforts and local notification must be improved to prevent vehicles from traveling through the sites during amphibian migrations.

Recommendations:

- Partners (ENSP, Conserve Wildlife Foundation of NJ, and NJ Audubon Society) should continue to collect survey data at manned crossings to gather supportive evidence for the need of management and to recruit, train, and manage volunteers to continue to conduct “drive-around” surveys in search of additional crossings.
- Partners should continue to recruit local towns to partner in this conservation effort by implementing temporary road closures 1–3 nights in March, annually, when migrations peak.
- Partners must provide local residents with pertinent information to prevent travel through the corridors during road closures and with local police to enforce the closures.
- Continue to expand the partnership with conservation organizations and land trusts, environmental commissions, and county park systems/ commissions.

JOB 4: NJ Herp Atlas Project

OBJECTIVE: To document distribution and relative abundance of New Jersey's reptiles and amphibians through comprehensive citizen-based surveys and to integrate these atlas findings into the Landscape Project. A web-base method of data collection and distribution will be used for conservation, planning, and education purposes.

Key Findings:

- The New Jersey Herp Atlas Project was initiated in 1995, which makes 2008 the 13th year of this long-term project. Completing a final and comprehensive report of the findings of this project was always one of the anticipated products. Last season it was decided that this report would take the form of a revised version of the “Field Guide to Reptiles and Amphibians of New Jersey”. In preparation for this guide ENSP began to create new distribution maps using data from the Herp Atlas Project and is now seeking new photographs of reptiles and amphibians from Herp Atlas volunteers. These photos will be used to update the “plates” within the existing field guide.
- Over the 2007/2008 project year, Herp Atlas volunteers submitted 7 endangered species sightings (including timber rattlesnakes and corn snakes), 228 sightings of threatened species (including eastern mud salamander, northern pine snake, Pine Barrens treefrog, and wood turtle), and 119 special concern species sightings (including: carpenter frog, eastern box turtle, Fowler’s toad, spotted turtle, eastern kingsnake, northern copperhead).
- In cooperation with USGS, 62 calling amphibian survey routes were established in New Jersey in 2003. In 2008, volunteers surveyed a total of 25 of these routes. Many of the routes were surveyed multiple times resulting in a total of 59 surveys as part of this project. Fourteen species were detected

statewide during the surveys. These data were incorporated into a state database as well as into the national North American Amphibian Monitoring Program's database.

- Two "Bio-blitzes" were carried out on state lands in 2006 and ENSP had proposed to conduct additional Bio-blitzes in 2007 and 2008. However, after fully evaluating the results from the 2006 Bio-blitzes the effectiveness of this type of survey effort for finding rare reptiles and amphibians was questioned by ENSP staff. As a result we did not carry out the proposed Bio-blitzes in 2007 or 2008 as it was the determination of staff the data collected by these efforts did not justify the effort that was needed to plan and organize the events.
- Italian wall lizards were originally identified in New Jersey in summer 2007. During the 2008 field season Herp Atlas volunteers surveyed for this species in the Mt. Laurel area of New Jersey. Wall lizards were documented in 3 out of the 6 sites that were surveyed (see map below).



- A grand total of 243 volunteer hours were logged for this project over the past year. These are broken down as follows: Herp Atlas volunteers reported a total of 125 hours and Calling Amphibian Monitoring Program volunteers reported 118 hours of volunteer time.

Conclusions:

- After 13 years of data collection, the Herp Atlas Project can be brought to a close. Completion of this project will entail completing a comprehensive report of the findings.
- The number of routes surveyed as part of the Calling Amphibian Monitoring Program (CAMP) decreased from 26 in 2007 to 25 in 2008.
- Surveys of Italian Wall Lizards found that there are at least three sub-populations of this species in the state.

Recommendations:

- Continue to recruit and train volunteers for the Calling Amphibian Monitoring Program so that each of the 62 New Jersey routes is surveyed in 2009.
- Bring closure to the Herp Atlas project over the next two years. Complete a final report for this project in the form of a revised version of the Field Guide to Reptiles and Amphibians of New Jersey.
- Initiate studies on the documented populations of northern leopard frogs and Italian wall lizards.

EXECUTIVE SUMMARY

Project: **Invertebrate Conservation**
Federal Aid Project: T-1-4 (State Wildlife Grants)
Segment dates: September 1, 2007 to August 31, 2008
Total Project Expenditures: \$46,600 (\$34,950 Federal, \$11,650 State)

JOB 1: State Listed Mollusks

This job is jointly supported by State Wildlife Grants and Section Six funding.

OBJECTIVE: To monitor populations and create conservation plans and strategies to aid in the recovery of listed species found throughout New Jersey, including the dwarf wedgemussel, brook floater, green floater, yellow lampmussel, eastern lampmussel, eastern pondmussel, tidewater mucket, and triangle floater.

Key Findings:

- We surveyed 17 stream sites totaling 35 station segments in eight counties for listed freshwater mussels during the survey period. Timed searches for mussels were conducted at historic locations and/or previously unsurveyed suitable habitats.
- We performed habitat assessments and/or preliminary searches at 28 additional sites in 12 waterways to determine if larger surveys were warranted.
- EPA Habitat Assessment Field Data Sheet scores (high and low gradient combined) ranged from 107 (Pompeston Creek, Burlington County) to 173 (South Branch Metedeconk River, Ocean County), out of a possible 200. Previous ENSP studies have shown that mussels occur in a range of 68-173, occurring most frequently at an average score of 121. All sites surveyed scored within the preferred habitat range.
- We compared individual habitat characteristic scores from EPA Habitat Assessment Field Data sheets (including but not limited to epifaunal substrate/available cover, sediment deposition, bank stability, and riparian width) with freshwater mussel abundance. In 2008, mussel abundance was most closely correlated to epifaunal/available cover scores. Other parameter scores associated with mussel abundance included sediment deposition, embeddedness and riparian zone width. Of the above-mentioned associations, prior investigations from 2000-2005 showed that total riparian zone width score was most closely associated with freshwater mussel abundance.
- Water quality values were as follows: pH ranged from 7.1 to 8.3, water temperatures ranged from 10.0 to 26 Celsius, dissolved oxygen ranged from 5.9 to 11.4 ppm.
- Catch per unit effort (CPUE) for all species combined during time searches was highest in the South Branch Metedeconk River, Ocean County, with 8.21 live mussels/minute and 15.79 shells/minute.
- We found ten species of freshwater mussels during field activities, including the Dwarf wedgemussel, Yellow lampmussel, Eastern elliptio, Eastern floater, Triangle floater, Alewife floater, Creeper, Tidewater Mucket, Eastern pondmussel and Paper pondshell. The Eastern elliptio was by far the most prevalent and widespread mussel species documented. Species richness was highest in the Stony Brook, Mercer County, with five species present.
- The Federal/State Endangered Dwarf wedgemussel was present at two locations along the Pequest River, Warren County. We found one live Dwarf wedgemussel and three shells in the Pequest River, Allamuchy Township. In addition, one fresh Dwarf wedgemussel shell was found in the Pequest River, Great Meadows. The Triangle floater (1 live, two shells), a state Threatened species and Creeper (one live), a state Special Concern species, were also present at the Allamuchy site whereas the Triangle floater was found at Great Meadows.

- Eastern pondmussels (Threatened) were documented in two segments at Pompeston Creek, Burlington County. We found nine live Eastern pondmussels and hundreds of fresh shells adjacent to protected land. The site had last been visited in 2002. In addition, five live Eastern pondmussels representing all age classes were documented in the Maurice River, Salem County. We discovered one *Ligumia* shell at this location that appears to be the black sandshell, *Ligumia recta*. If confirmed, this will be the first record of the black sandshell in the state.
- We documented a new location for the Tidewater mucket (Threatened) in the South Branch of Rancocas Creek, Burlington County. One of the shells was fairly new, with a shiny nacre and little weathering.
- We recorded Triangle floaters (T) at eight survey locations and four sites assessed for habitat suitability. Creepers (SC) were documented at three survey locations and one site assessed for habitat suitability.
- A single, live Yellow lampmussel (T) was discovered in the northern portion of the Delaware River during a habitat suitability assessment.
- Volunteers continued to identify and survey freshwater mussels as part of the freshwater mussel atlas effort. The volunteers are covering Burlington, Salem and Mercer counties. Volunteers were given copies of the draft field guide, along with other information and sample shells of common species. To date, volunteers have collected data from three river systems.
- The field guide to freshwater mussels of NJ is in draft format and undergoing final review.
- All new locations found to have federal and/or state listed mussels have been/ are in the process of being incorporated into the Biotics database. These locations, along with sightings from previous surveys, will be used in Riparian Landscape Project mapping to identify critical areas for listed mussel populations.
- ENSP began developing a methodology to streamline the Category 1 site selection process based on the presence of listed freshwater mussels and other aquatic obligate species.

Conclusions:

- Based on habitat suitability assessments and preliminary searches, 15 out of 28 sites warrant further survey work to determine freshwater mussel species composition and abundance.
- Differences in the 2000-2005 vs. 2008 habitat characteristic analyses (riparian zone width vs. epifaunal/available cover as most closely correlated to mussel abundance) may reflect differences in site selection methods. Earlier survey sites were largely chosen to overlap with DEP's Ambient Biomonitoring Network (AMNET) locations as part of the Integrated Biological Aquatics Assessment (IBAA); these were generally at road crossings or in other easily accessible and more exposed areas.
- The new Dwarf wedgemussel sightings in the Pequest River expand the upper population boundary by approximately five miles. Based on previous sightings, Dwarf wedgemussels may occupy a stream segment of approximately 16 miles in length.
- Discovery of Dwarf wedgemussels in a new area of the Pequest River underscores the need for more surveys in New Jersey. It is possible that other populations occur in the previously unsurveyed streams with suitable habitat and appropriate host fishes present.
- The Stony Brook, despite fluctuating flow, serves as critical habitat for a variety of listed and rare freshwater mussels.
- Based on SWG funded and previous ENSP freshwater mussel surveys, Triangle floaters are widespread but not abundant, indicating that the Threatened status is still warranted.

Recommendations:

- Continue surveys for listed species in previously unsurveyed suitable habitats to document distribution.
- Continue collecting and analyzing habitat data to determine relationships with freshwater mussel abundance and diversity.

- Continue focusing survey efforts in the Pequest River to determine Dwarf wedgemussel population boundaries and size.
- Conduct searches in the South Branch Rancocas Creek and tributaries between the location of the tidewater mucket sighting and the Delaware River to determine whether the species occurs in other sections of the waterway.
- Conduct a status assessment using the Delphi method of native freshwater mussels in the next two years.
- Continue to refine Category 1 site selection process based on the presence of aquatic obligate species. Work with DEP's Water Monitoring and Standards to recommend stream classification upgrades in areas with listed mussels using the new methodology.
- Continue work on atlas and solicit assistance from additional Wildlife Conservation Corp (WCC); train volunteers to identify and survey for mussels; assign specific areas for survey work where data are lacking.

JOB 2: Federal and State-Listed Lepidoptera

OBJECTIVE: To identify, survey, protect, and manage for listed Lepidoptera populations and habitats in New Jersey. Listed species include arogos skipper, Mitchell's saytr, bronze copper, Appalachian grizzled skipper, checkered white, silver-bordered fritillary, and frosted elfin. For the 2006 field season, surveys will focus on identifying new colonies of arogos skipper, and frosted elfin.

Key Findings:

- We visited 7 out of the 11 documented Silver-bordered Fritillary sites in the state at least twice between May and August of 2008. One out of the 7 sites surveyed were positive for Silver-bordered Fritillary with a total of 2 individuals observed during the survey period. Surveys were also conducted at sites possessing suitable habitat for this species. A total of 12 potential sites were surveyed and individuals of this species were observed at 6 locations. Several of these locations represent new populations within a previously undocumented area of the Delaware Water Gap National Recreation Area. Other sites surveyed were located in suitable habitat within the vicinity of historical locations.
- Since this was the first extensive surveying effort ever carried out for the Silver-bordered Fritillary in New Jersey it is difficult to make informed conclusions on the population viability of this species in the state. One anecdotal field observation made during the 2008 field season was that invasions of exotic species and natural succession may be reducing the suitability of some of the historic sites for this species and could explain why no individuals were documented during this survey.
- Although ENSP did not conduct targeted surveys for Arogos Skipper during the 2008 field season we did work with military installations in the Pinelands Region to put together a DOD Legacy grant proposal for Arogos Skipper. In this proposal, which has received preliminary funding approval by DOD, funding of \$98,000 is requested to survey for Arogos Skipper in the Pinelands and to develop a "Lepidoptera Management Plan for Southern New Jersey". Participating military installations include Fort Dix, Lakehurst Naval Air Engineering Station, and McGuire Air Force Base.
- New species occurrence data was entered into the Biotics Database for Silver-bordered Fritillary.

Conclusions:

- Silver-bordered Fritillaries continue to persist in a minimal number of historic sites within the State but there exists the potential for finding new occurrences with expanded surveying efforts.

Recommendations:

- Continue surveying of historical sites and conduct further surveys of other sites that contain suitable habitat.

- Survey habitat characteristics and structure to compare present sites with historical sites to determine habitat needs and potential mechanisms behind the metapopulation structure of this species.

JOB 2B: Frosted Elfin

OBJECTIVE: To survey suitable habitat for this species and manage habitats for the proliferation of its host plant when appropriate.

Key Findings:

- In 2008, we surveyed only 4 out of the 13 documented frosted elfin sites in the state at least twice between May and June. Each of these sites was found to have frosted elfins present, with a total of 72 individuals of this species observed during the survey period.
- Two of the 4 sites surveyed in 2008 were the Beaver Swamp North and Beaver Swamp South frosted elfin colonies. These sites were each visited once in late-May and once in Mid-June by ENSP staff. A significant feature of these sites is that ENSP worked with the property owner (Atlantic City Electric) to carry out habitat management for frosted elfins each location during the 2006/2007 winter. In 2007, only 14 individuals of this species were observed at both sites. This number rose slightly in 2008, with a total of 25 individuals being observed at the two sites combined. The proposed plant surveys within frosted elfin habitats were carried out (and reported on) in 2007 and therefore unnecessary in 2008.
- Our original plans to carryout repatriation of this species into historic sites have been put on hold indefinitely due to restraints on staff time.

Conclusions:

- Frosted elfin continue to persist at many of the historic sites in the state despite minimal habitat management.

Recommendations:

- Continue to survey the two frosted elfin sites that were mowed in winter 2006/2007 to estimate frosted elfin numbers in 2009.
- Work with utility companies to determine best management practices on rights-of-way where frosted elfin habitat is present.
- Reinitiate habitat enhancement/creation activities in areas where soil characteristics are suitable for the planting of wild indigo.

JOB 3: Rare Odonata Conservation

OBJECTIVE: To evaluate the status of rare Odonata species in New Jersey and proceed with the state listing process for those species that warrant the status of threatened or endangered. Routine surveys for rare Odonata species will be an important component of the long-term protection of rare Odonata in New Jersey. This project will also investigate the role of hydrological and water quality issues that may affect habitat suitability and population trends. Management will involve integrating habitat needs into forestry, farming and other land use practices, combined with habitat restoration and protection of concentration areas.

Key Findings:

- The Gray Petaltail (*Tachopteryx thoreyi*), recommended for listing as as state Endangered, was once reported sporadically from the Highlands, Ridge and Valley, and Northern Piedmont areas of NJ. Surveys over the past several years have failed to located individuals of the species.
- The reintroduction of the Gray Petaltail, undertaken during May 2007, at a large woodland seepage in Trout Brook WMA, Sussex County, NJ continued to be monitored in 2008.
- Weekly monitoring (and twice/week in the first 2 weeks in June) of the reintroduction site resulted in the observation of five live adults (four males, one female) during the course of 12 visits from late May through early July 2008. A single dead male was discovered during a visit in early June.
- It is significant to note that the single female observed was ovipositing (egg laying) which suggests breeding has commenced within this small population.

Conclusions:

- An undetermined number of larvae from the original (2007) re-introduction survived the winter months and successfully emerged in the spring.
- Breeding has commenced to some degree at the site as evidenced by the observation of a single female ovipositing in the seepage.

Recommendations:

- Continue to monitor reintroduction site during May-July 2009 and a subsequent two years to determine whether a population is becoming established.
- Monitor nearby suitable habitat within a radius of one mile from the reintroduction site for the presence of stray adults.
- Continue to identify suitable habitat elsewhere and conduct surveys for the presence or absence of this species.

EXECUTIVE SUMMARY

Project: Species Status Review
Federal Aid Project: T-1-4 (State Wildlife Grants)
Segment dates: September 1, 2007 to August 31, 2008
Total Project Expenditures: \$16,000 (\$12,000 Federal, \$4,000 State)

JOB 1: Species Status Review and Listing

OBJECTIVE: Determine the status and distribution of endangered and threatened wildlife, and species of special concern.

Key Findings:

MARINE MAMMALS:

- The status review of 36 species in this group continued with 13 reviewers with expertise in pinniped and/or cetacean biology and behavior participating.
- For the review, the panel was asked to choose a status and confidence level for 36 marine mammals. Definitions for status (endangered, threatened, special concern, undetermined, not applicable or no opinion) were provided to panelists, along with a numeric scale reflecting confidence level. Reviewers were asked to provide comments supporting their status selections. Species were chosen for review based on the existing list of NJ nongame species and other sources documenting presence within state waters.
 - The species being reviewed include 15 whales, 15 dolphins, one porpoise, four pinnipeds, and the West Indian manatee. Reviewers were provided with various sources of information pertaining to the species under review, including NOAA stock assessments, recovery plans, distribution maps, and reports from New York and Canada. Information was provided to each reviewer via CD and secure website.
 - Three rounds (rounds 2 through 4) were completed during this segment. Upon completion of the fourth and final round, consensus was achieved on 25 out of 36 species as follows:
 - State Endangered (3 species) – fin whale, humpback whale, and northern right whale;
 - Special Concern (2 species) – bottlenose dolphin and harbor porpoise;
 - Secure/Stable (2 species) – gray seal and harbor seal;
 - Undetermined (2 species) – short-finned pilot whale, striped dolphin;
 - Not Applicable (16 species) – beluga whale, Blainville’s beaked whale, clymene dolphin, Cuvier’s beaked whale, dwarf sperm whale, Gervais’ beaked whale, killer whale, melon-headed whale, northern bottlenose whale, pantropical dolphin, pygmy killer whale, pygmy sperm whale, spinner dolphin, True’s beaked whale, West Indian manatee, and white-beaked dolphin.
 - No consensus was achieved on the following 11 species: Atlantic spotted dolphin, Atlantic white-sided dolphin, blue whale, common minke whale, harp seal, hooded seal, long-finned pilot whale, Risso’s dolphin, sei whale, short-beaked common dolphin, and sperm whale.
- Those species for which consensus could not be reached fall within two general groups:
 - Species that remain globally vulnerable to extinction and yet are neither documented nor suspected to occur within New Jersey waters (blue, sei and sperm whales). These three species have been included upon New Jersey’s list of endangered species due to their federal listing and because they do occur within the North Atlantic. However, while they do occur within the North Atlantic, only sick, dying or dead individuals have been documented within New Jersey waters.
 - Species that are largely thought to be globally secure and yet are neither documented nor suspected to occur within New Jersey waters (Atlantic spotted dolphin, Atlantic white-sided dolphin,

common minke whale, harp seal, hooded seal, long-finned pilot whale, Risso's dolphin, and short-beaked common dolphin).

TERRESTRIAL NONGAME MAMMALS:

- Preliminary coordination for the status review of 39 species in this group began during this segment. Eight reviewers agreed to participate in the status review process. Reviewers were chosen based on their expertise regarding terrestrial mammal biology and/or behavior. Participants represent the NJ Division of Fish and Wildlife (Endangered and Nongame Species Program and Bureau of Information and Education), Union College, Drexel University, William Paterson University, Montclair State University, Rutgers University and the NJ State Museum.
- All status review forms, species maps and relevant species data were compiled and made ready for distribution to participating reviewers.
- It is expected that a minimum of three rounds (iterations) of the terrestrial mammal status review will be completed in the coming project year.

Conclusions:

- Marine mammal species were reviewed for state status assignment. Staff will review the status assessment results and make status recommendations to the Endangered and Nongame Species Advisory Committee and to the DEP Commissioner.
- A review panel was initiated for the status assessment of terrestrial nongame mammals.
- The Endangered and Nongame Species Program staff has affirmed the Delphi technique (Clark *et al.* 2006) as an appropriate, objective method for determining species status, which should continue to be the method used by the Division.

Recommendations:

- Begin the administration of the status review of terrestrial nongame mammals, and complete the iterative assessment rounds as necessary to reach consensus on status of species under review.
- If the status review process for terrestrial nongame mammals is completed by the end of the project year, compile the results of the Delphi review and present them to the Endangered and Nongame Species Advisory Committee for recommendations on new status assignments.
- Compile the results of the status review of marine mammals and present them to the Endangered and Nongame Species Advisory Committee for recommendations on new status assignments.
- Proceed with recommended status assignments by advising the regulatory (rulemaking) process.

EXECUTIVE SUMMARY

Project:	The Landscape Project & Natural Heritage Program Database
Federal Aid Project:	T-1-4 (State Wildlife Grants)
Segment dates:	September 1, 2007 to August 31, 2008
Total Project Expenditures:	\$489,300 (\$366,975 Federal, \$122,325 State)

JOB 1: Critical Habitat Mapping

OBJECTIVE: Design, refine and make available critical habitat designations using the most current data on rare species populations and land cover types.

Key Findings:

- ENSP incorporated approximately 1,586 new or updated Species Occurrence Areas (SOA) for use in Landscape mapping.
- Staff created and documented a new SOA approach to defining suitable habitat parameters.
- Staff updated Version 3.0 of Landscape Project for the Highlands region of New Jersey. This version incorporates a more species-specific habitat approach using NJ Department of Environmental Protection's 2002 Level III Land Use/Land Cover (LU/LC 2002) habitat typing. This methodology was developed, documented, and applied to the Highlands region first, with plans to extend it statewide. This dataset was completed and released May 2008.
- Staff created an update to Version 2.0 using new SOA files and updated LU/LC 2002 base data. The Version 2.0 report included a refined and documented peer review process. This dataset was completed and released May 2008.
- Release of updated Landscape project included the creation of 12 new/updated Landscape Project GIS layers; Landscape Version, Bald Eagle Foraging, Beach Version 2.1, Emergent Wetlands version 2.1, Forest Version 2.1, Forested Wetlands Version 2.1, Grassland Version 2.1, Urban Peregrine Version 2.1, Wood Turtle Version 2.1, Species Based Patches within the ENSP Highlands Extended Boundary Version 3.0, Streams within the ENSP Highlands Extended Boundary Version 3.0 and Vernal Habitat within the ENSP Highlands Extended Boundary Version 3.0.
- All Landscape Project GIS data was made available in both Shapefile and file geodatabase format and fully documented with Federal Geographic Data Committee (FGDC) compliant metadata. The data is served on the NJDEP Bureau of GIS website for download as well as on the NJDEP interactive mapping application.
- Landscape Project Data, Version 2.1 and 3.0 were fully documented in two reports available for download from ENSP's website (<http://www.njfishandwildlife.com/ensp/landscape/index.htm>).
- Staff updated Critical Wildlife Habitat mapping within the Coastal Areas Facilities Review Act (CAFRA) zone, as documentation of present habitat that is afforded extra protection under CAFRA regulations. Besides updating the mapping within CAFRA, ENSP created an extension of the CAFRA zone called waterfront development zone (CAFRA/WF). These two areas were combined and represent the full extent of where the CAFRA rules will be implemented for Critical Wildlife Habitat protection. Critical Wildlife Habitat for the CAFRA/WZ is under review by the Division of Land use Regulation.
- ENSP did not complete an aquatic component to the Landscape Project map due to time constraints. Staff determined it was more critical to update Version 2.0 with the NJ DEP's 2002 Level III LU/LC. As no new products were created, it was unnecessary to convene the peer review panel.
- Land Use/Land Cover in the CAFRA/WZ zone was compared between 1995 and 2002; the following summarizes the results.

Type LU/LC	1995 LU/LC acreage	2002 LU/LC acreage	Change acreage
Agriculture	55,866	51,800	-4,066
Barren Land	17,199	18,076	+ 877
Forest	135,185	126,242	-8,943
Urban	248,042	263,114	+ 15,072
Water	220,602	221,353	+ 751
Wetlands	347,283	343,593	- 3,690
Totals	1,024,177	1,024,177	

- The CAFRA/WZ zone comprises 1,024,177 acres; ENSP has designated 246,879 acres (24%) as Critical Wildlife Habitat. This mapping is being reviewed and may be modified before final release.
- Pilot projects for each of the Landscape Regions were not completed due to lack of staff time.
- It was not necessary to hold meetings with state planning and regulatory agencies regarding map revisions as version 3, the current version being implemented, was reviewed three years ago.

Conclusions:

- While updating Version 3.0 of Landscape Project for the Highlands region, it was decided that implementing Version 3.0 methodology statewide would take longer than expected, so ENSP created an update to Version 2.0. The update to Version 2.0 included new sightings information through the use of the updated SOA file, and a new base layer, the NJ DEP 2002 Level III LU/LC.
- Version 3.0 mapping methodology, according to biologists' review, more accurately represents species habitat needs than previous versions of the Landscape Project.

Recommendations:

- By November 2009, release a statewide version of the Landscape Project that incorporates Version 3 methodologies, addressing all state listed species for which we have occurrence data.
- Continue the peer review process on new methodologies.
- Develop a release plan for the Landscape Project products and, to the extent possible, minimize delays in product updates.

JOB 2: Landscape Project Stepped-Down Planning

OBJECTIVE: Build knowledge of critical habitat locations to guide land management, habitat conservation and acquisition, and land planning at all levels of government and non-government organizations.

Key Findings:

- Staff provided 20 information/training sessions attended by approximately 250 people.
 - Provided guidance to representatives of municipal agencies including environmental commissions and planning boards; county agencies including Essex County Mosquito Control, Gloucester County Planning, Hunterdon County Parks, Middlesex County Planning, Monmouth County Parks, Ocean County Engineering, Sussex County Planning, Warren County Planning and Engineering, Warren County Mosquito Commission; state organizations including NJ Department of Transportation, NJ Department of Agriculture, NJDEP's Office of Planning and Sustainable Communities, Office of Compliance and Enforcement, Office of Environmental Review and the Division of Land Use Regulation; NGOs and private consulting firms as well as the general public. Also provided instruction on the creation and use of the Landscape Project through Rutgers University's continuing education course.

- Presented the Landscape Project at the Alliance for New Jersey Environmental Education (ANJEE) Annual Conference, the Mid-Atlantic Chapter of the Urban and Regional Information Systems Association's (MAC-URISA) Regional GIS Conference and provided Landscape Project information at three regional Wildlife Action Plan Public Open Houses.
- Provided training for and partnered with NJDEP's newly formed Office of Planning and Sustainable Communities to extend Landscape Project information and training to county and municipal planners in an effort to promote integration of critical habitat management into existing and developing habitat management plans.
- Landscape Project reports detailing the methodology employed to create the new version of the Landscape Project in the Highlands Region (3.0) and outside the Highlands Region (2.1) were made publicly available on the web for viewing and download as Portable Document Format (PDF) files.
- Staff finalized and published an interactive map book available on the web for viewing and download as Portable Document Format (PDF) files.
- Staff created a CD containing Landscape Project data for public distribution.
- Staff continued to provide support to the Division of Natural and Historic Resources' *Standard Operating Procedure* for screening actions to determine if they will have an adverse impact on threatened and endangered species habitat.

Conclusions:

- Offering Landscape Project training and information sessions is essential to the success of the Landscape Project. Making the product publicly available does not necessarily encourage proper use of Landscape Project maps; the Landscape Project has greater impact when creation and distribution are done in conjunction with offering guidance information and training to ensure its correct usage.
- Partnering with NJDEP's Office of Planning and Sustainable Communities and other agencies to target and organize potential end-users is an effective way to administer Landscape Project training and information.
- Through the Natural and Historic Resources' (NHR) internal project review process, NJDEP-owned lands are being screened at a more restrictive level than required by current land-use regulations.

Recommendations:

- Continue to provide guidance to state, federal, and municipal agencies and conservation groups.
- Continue to work closely with NJDEP's Office of Planning and Sustainable Communities to facilitate dissemination of Landscape Project information and training to municipal and county planning organizations.
- Continue to provide assistance to the NHR in support of the screening tool.
- Continue to provide training and guidance to the Department's environmental review groups.

JOB 3: Wildlife Action Plan Stepped-Down Planning

OBJECTIVE: To coordinate the implementation of the NJ Wildlife Action Plan (Plan) through outreach to NJ's stakeholders, land and wildlife stewards, and citizens.

Key findings:

- ENSP (in partnership with the Conserve Wildlife Foundation of NJ and the Environmental Law Institute) held the last of five regional meetings, September 12, 2007, to develop the list of priority conservation actions within the Delaware Bay and to refine/revise these actions to include measurable outcomes and stakeholders' comments and recommendations.
 - Participants discussed the conservation goals and actions outlined within the Delaware Bay Region, shared comments and recommendations, and finally conducted a prioritization exercise

to select those actions deemed most important for resource allocation in the 3-5 year planning time frame.

- One hundred fifty-four participants were invited from various agencies and organizations (both traditional and non-traditional partners); 29 attended.
- Participants reviewed 104 specific and broad-based* conservation actions; selecting 55 priority actions.
- Summary report of the meeting was distributed to the participants.
- Internal follow-up meeting was held to discuss the comments and recommendations and revisions were made to the Plan per the discussion from this meeting and a revised version (January 23, 2008) of NJ's Wildlife Action Plan was posted on the Division of Fish and Wildlife's Web Site (<http://www.njfishandwildlife.com/ensp/waphome.htm>).
- The meeting location was hosted by the NJ Audubon Society's Center for Research and Education.

**For the purpose of the prioritization exercise, conservation goals and conservation actions that were similar between conservation zones (sub-regional levels) were consolidated into one conservation goal or action. Such an action selected as a priority during the meeting would then affect all similar or related actions within the relevant conservation zones, making all of them priority actions.*

- Urban-focused Landscape Meeting:
 - ENSP and the Conserve Wildlife Foundation of NJ co-hosted the second informal urban-focused landscape meeting (September 7, 2007) with a sub-set of 10-15 stakeholders to:
 - Further discuss the value of urban landscapes and surrounding areas to NJ's wildlife and the issues to consider within urban areas.
 - Develop a list of targeted issues to address at future regional meeting(s).
- The summary reports of the Atlantic Coastal and Pinelands Regional meetings, held during the 2007 segment, were distributed to the participants.
- ENSP (in partnership with the Conserve Wildlife Foundation of NJ) co-hosted three regional (north, central, south) landscape public open houses in an effort to engage New Jersey citizens in conservation efforts throughout the state, help them understand their role in conservation, and demonstrate how the State Wildlife Action Plan (Plan) can help provide focus for their conservation efforts.
 - Northern Meeting was held June 10, 2008, 6:00 pm – 9:30 pm:
 - Conservation partners, in addition to the Conserve Wildlife Foundation of NJ, participating at the open house to display projects implementing the Plan included the NJ Audubon Society, Dept. of Agriculture - National Resource Conservation Service, Morris County Park Commission, a private ecological consultant, Michael VanClef, Ducks Unlimited, Friends of Hopewell Valley Open Space, and The Nature Conservancy – NJ Chapter.
 - Sixteen citizens attended the open house.
 - Southern Meeting was held July 10, 2008, 6:00 pm – 9:30 pm:
 - Conservation partners, in addition to the Conserve Wildlife Foundation of NJ, participating at the open house to display projects implementing the Plan included the NJ Audubon Society, Dept. of Agriculture - National Resource Conservation Service, Duke Farms Foundation, NJ Conservation Foundation, Citizens United to Protect the Maurice River, the Great Egg Harbor Watershed Association, and Forsythe National Wildlife Refuge.
 - Fifteen citizens attended the open house.
 - Central Meeting was held July 24, 2008, 6:00 pm – 9:30 pm:
 - Conservation partners, in addition to the Conserve Wildlife Foundation of NJ, participating at the open house to display projects implementing the Plan included the NJ Audubon Society,

- Dept. of Agriculture - National Resource Conservation Service, Duke Farms Foundation, the NJ Conservation Foundation, and the NJ Farm Bureau.
 - Ten citizens attended the open house.
- ENSP staff have been working with a professional editor and artist to develop five region-based Wildlife Action Plan pamphlets highlighting the regional priority conservation goals and actions.
 - Text for the five current regions identified in the Plan (Delaware Bay, Skylands, Pinelands, Piedmont Plains, and Atlantic Coast) has been developed and is undergoing final approval from the NJ Department of Environmental Protection (DEP).
 - Three of the five pamphlets have already been prepared and await potential revisions per the DEP.
- ENSP Wildlife Action Plan Coordinator is working with staff and conservation partners to determine how to make the Plan more user-friendly.
 - One meeting was held between ENSP, the Conserve Wildlife Foundation of NJ, and the NJ Audubon Society to discuss a potential plan and timeline.
 - Staff and partners have been working to generate a list of potential members that use or would benefit from using the Plan for a steering committee to help guide this process.
- ENSP staff continues to work on the extraction of the *Ocean Conservation Zone* from the Atlantic Coastal Regional Landscape within the Plan to create a sixth region, Marine.
- ENSP staff has been using the Plan to guide future work, but has not completed a 5-year implementation plan as outlined in the 2005-2006 project proposal (SWG proposal 2005).
 - ENSP staff continued to work on the jobs staff identified to address the compiled list of priority and non-priority state-level goals and strategies by 1) identifying the most appropriate partner(s) best suited to accomplish each task/ job and 2) identifying priority actions that fall outside of the ENSP's jurisdiction/responsibility, and identifying a plan of action to move these issues ahead.
 - ENSP staff compiled priority and non-priority region-level goals and actions for internal review and research planning discussion, identified specific jobs needed to address these actions, and identified the appropriate partner(s) best suited to accomplish each task/ job.
- ENSP Wildlife Action Plan Coordinator continues to assist interested parties in using the Plan to seek grants, understand conservation objectives, and encourage partnerships when requested. Due to time constraints, the Wildlife Action Plan coordinator has not actively begun coordinating partnerships for implementation.
- Due to funding constraints, ENSP did not pursue obtaining an Assistant Wildlife Action Plan Coordinator to help coordinate implementation of the Plan.

Conclusions:

- Regional landscape meeting with stakeholders was successful in refining the Wildlife Action Plan and identifying priority targets to focus conservation efforts in NJ.
- Many NJ citizens and organizations (local government agencies, sportsmen groups, watershed associations, and etcetera) are still not well informed of the Plan's existence and purpose.
 - Public Open Houses were not considered successful as few citizens attended.
- Development of the region-based information pamphlets highlighting regional priority conservation goals and actions was not completed in the timeline set forth, however they should be completed with only a slight extension, approximately two - three months, due to the number of revisions that have occurred during the development process.
- Revisions to the Plan, to incorporate a Marine section and remove the *Ocean Conservation Zone* from the Atlantic Coastal Regional Landscape, are in progress.
- Development of a 5-year implementation work plan will require input from DEP's upper administration, including those in the Division of Policy and Planning.
- Obtaining an Assistant Wildlife Action Plan Coordinator would help streamline the process of making revisions to the Plan and jumpstart coordination of implementation with potential partners.

Recommendations:

- ENSP to complete revisions to the Plan, post the most up-to-date version on the DFW website, and notify the USFWS of revisions.
- Complete the development of and distribute region-based Wildlife Action Plan pamphlets.
- Develop and distribute a sixth region pamphlet for the Marine section once complete.
- Continue to pursue completion of ENSP's 5-year implementation plan as outlined in the 2005-2006 project proposal (SWG proposal 2005).
- ENSP must continue to work with partners in conservation to publicize the Plan's existence, purpose, and benefits, and encourage partnerships in land management and research at all levels.

JOB 4: Biotics Database

OBJECTIVE: Update and maintain the most current data on rare species populations.

Key Findings:

- Biotics staff have received approximately 2,298 rare animal records from the public (n = 1,119) and from ENSP staff (n = 1,184) (n = 5 were not assigned a source). Approximately 2,643 rare animal records have been entered into Biotics and of those approximately 1,000 were updates to previously mapped records. Approximately 1,178 records have been reviewed by biologists. There remains a backlog of approximately 1,100 endangered and threatened species records that have been reviewed and accepted by biologists and are awaiting entry into Biotics.
- Biotics staff have focused on getting records of several key species up-to-date in Biotics, for which several years of backlog had built up. The species completed this year include black-crowned night-heron, black skimmer, least tern, piping plover, wood turtle, yellow-crowned night-heron, wintering eagles and several special concern species. Mapping methodology prescribed by NatureServe has been implemented for those same species.
- Created and released corrected version of Species Occurrence Area Version 3 (SOA_3) and Source Features Version 3 files, which rectified a few errors discovered after the initial release in August 2007.
- Some data previously maintained outside Biotics and used for SOA creation (wood turtles and New York colonial waterbirds), have been integrated into Biotics.
- Continued to work with biologists to standardize the labels (feature labels) used in Biotics to describe rare species observations across species groups and correspondingly update the SOA buffer sizes applied to observations and assure we have documented buffer size justifications.
- Citrix, a means of accessing the Biotics database remotely through the internet, has been established and a representative from DEP's Office of Information Management is working on making the application compatible for multiple users.
- A Biotics data entry user's manual has been finalized, which will ensure standardized entry of data.
- Developed a contract with Rutgers University's Center for Remote Sensing and Spatial Analysis (CRSSA) to build a web-based mapping and data submittal application for rare animal occurrences. Iterations of a prototype have been reviewed by ENSP GIS staff and biologists.
 - As the web-based submittal application is still in the development phase, ENSP has not publicized its availability.
- Worked with NatureServe to update software on the server that houses the Biotics components in the DEP, which included the installation of Exchanger software we previously did not have.
- Agreements with other states have been put on hold until the backlog of data is more manageable and the feature label standardization project is complete.

Conclusions:

- Biotics staff have entered more records into Biotics than were received, though there still remains a backlog of records to enter into Biotics. The biologists have reviewed far fewer records than were received.
- Approximately 45% of animal records in Biotics still need to be quality controlled.
- Only one source of data stored outside of Biotics needs to be used to create the SOA files and work has begun to integrate those data into Biotics.
- Biotics staff have brought several species up to date in Biotics so that the database can serve as the sole source of data for those species.
- Citrix allows more individuals to access and enter data into Biotics and the user's manual will assure standardized entry of data by multiple individuals. The multi-user capabilities of Citrix were delayed in development due to technical issues, which are now being resolved.
- Over 12 months passed between releases of an updated SOA file.
- Rutgers University's CRSSA has begun work on the development of an electronic submittal application, which will streamline review and data entry of rare animal locations. Work should be complete by early 2009. The application will be publicized once it is complete.

Recommendations:

- Finish species' focused projects so that all endangered and threatened species data are up-to-date in Biotics and Biotics is the sole source of data constituting the SOA and Source Feature files in the future.
- Allow a small number of staff in field offices to enter data into Biotics via Citrix to help with the backlog of data entry and quality control.
- Complete the standardization of feature labels for all animal records in Biotics.
- Establish deadlines to ensure an update of the SOA and Source Feature files are ready for release every 6 months.
- Continue working with CRSSA to complete the development of the electronic data submittal application. The application will streamline the data submittal, review, and entry process and thus enable Biotics staff to enter and update many more records in Biotics than is currently possible. Once complete, publicize the electronic sighting submittal website so as to transition as quickly as possible to a more streamlined system and educate the public about the importance of reporting rare species observations.
- Proceed with a data exchange with NatureServe in the spring of 2009. This will be the first data exchange ENSP has participated in since taking over control of the animal data within Biotics 4 years ago. The exchange will update the global element data in our New Jersey Biotics database as well as update the central database with rare animal data in New Jersey enabling NatureServe to maintain an up-to-date representation of biodiversity elements in North America.

LITERATURE CITED

- Baker, A. J., P. M. González, T. Piersma, L. J. Niles, I. L. S. do Nascimento, P. W. Atkinson, N. A. Clark, C. D. T. Minton, M. K. Peck, and G. Aarts. 2004. Rapid population decline in red knot: fitness consequences of decreased refueling rates and late arrival in Delaware Bay. *Proceedings of the Royal Society B* 25:125-129.
- Clark, K.E., J.A. Applegate, L.J. Niles, and D.S. Dobkin. 2006. An objective means of species status assessment: adapting the Delphi Technique. *Wildlife Society Bulletin* 34:419-425.
- Hernandez, D. 2007. The Richard Stockton College of New Jersey, Pomona, NJ
- LoGuidice, Kathleen. 2000. *Baylisascaris procyonis* and the decline of the Allegheny woodrat (*Neotoma magister*). Ph.D. dissertation, Rutgers, The State University of New Jersey, 101pp.
- McGowan, E. 1993. Experimental release and fate study of the Allegheny woodrat (*Neotoma magister*). Unpublished report of New York State Department of Environmental Conservation, Endangered Species Unit. 15 pp.
- McGowan, C.P. and T.R. Simons, 2005. A method for trapping breeding adult American Oystercatchers. *Journal of Field Ornithology*. 76(1): 46-49.
- Niles, L.J., A.D Dey, N.J.Douglass, J.A. Clark, N.A. Clark, A.S. Gates, B.A. Harrington, M.K. Peck, and H.P. Sitters. 2006. Red Knots wintering in Florida: 2005/6 expedition. *Wader Study Group Bull.:* 86-99.
- Niles, L. J., H. P. Sitters, A. D. Dey, A. J. Baker, R. I. G. Morrison, D. E. Hernandez, K. E. Clark, B. A. Harrington, M. K. Peck, P. M. Gonzalez, K. A. Bennett, K. S. Kalasz, P. W. Atkinson, N. A. Clark, C. D. T. Minton, C. Espoz, R. Matus N., I. L. Serrano. 2007. Status of the Red Knot (*Calidris canutus rufa*) in the Western Hemisphere. 270p. Prepared for US Fish and Wildlife Service, Ecological Services, Region 5, NJ Field Office, Pleasantville, NJ 08232.
- Niles L,J., J. Bart, A.D Dey, H.P.Sitters, P.W Atkinson, A.J. Baker, K.A. Bennett, K.E. Clark, J. Clark, N.A. Clark, A.S. Gates, S. Gillings, P.M. Gonzalez, D.E. Hernandez, K.S. Kalasz, C.D.T. Minton, R.I.G. Morrison, R.R. Porter, R.K. Ross, and C.R. Veitch In Press. Effects of horseshoe crab (*Limulus polyphemus*) harvest in Delaware Bay on red knots (*Calidris canutus rufa*): Are harvest restrictions working? *Bioscience*
- Peters, K.A., and D.S. Mizrahi, 2007. Semipalmated and Least Sandpiper Stopover Dynamics on Delaware Bay during Spring Migration. Final Report to New Jersey Department of Environmental Protection Endangered and Nongame Species Program.